AUGUST 1963 35 CENTS ICD

SCIENCE DIGEST

YOUR DAYDREAMS CAN WORK FOR YOU

EDISON IN PICTURES
his life, his wives, his work

HOW TO CHOOSE THE RIGHT DIET

The great lie-detector hoax

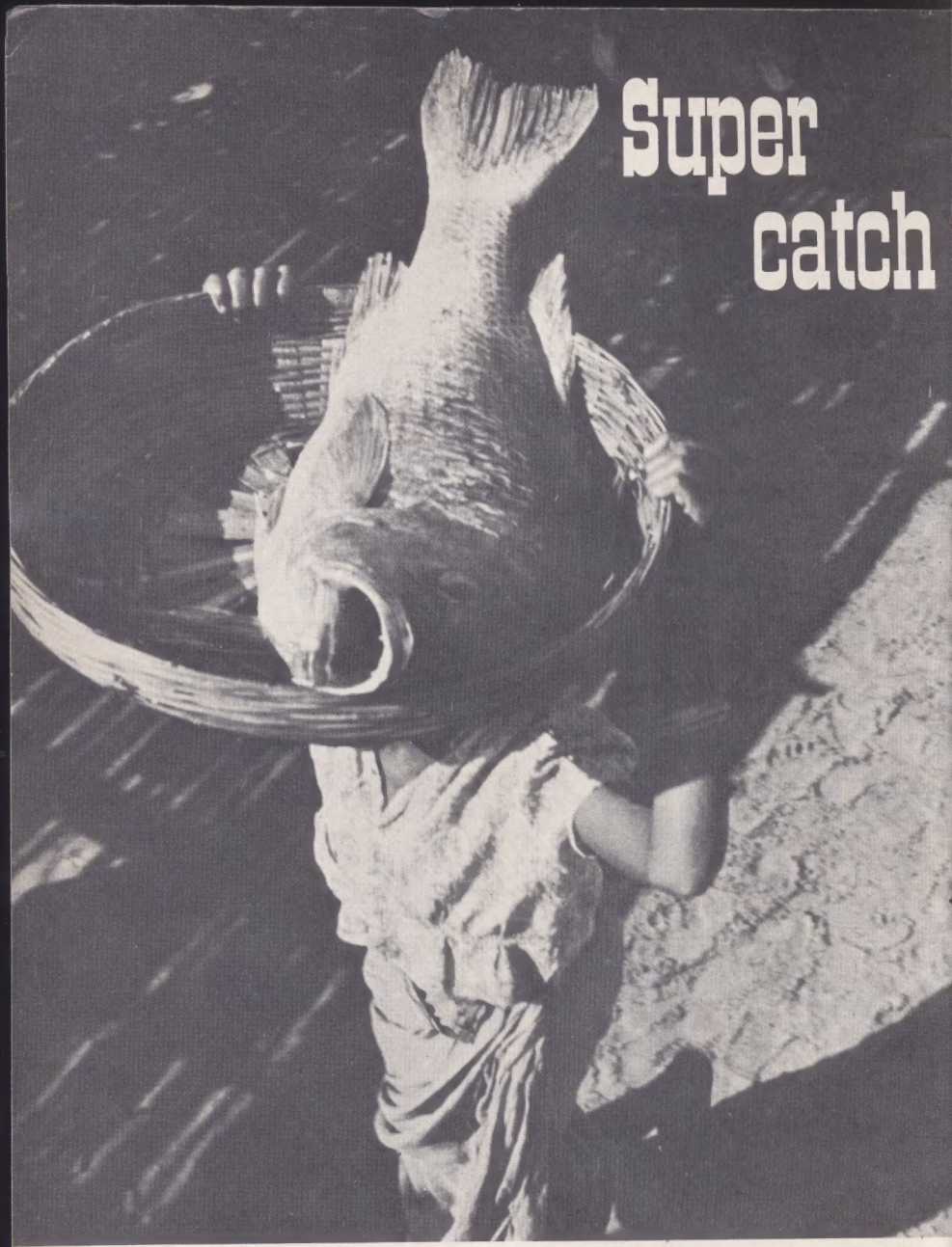
ARE THE NEW ANESTHETICS SAFE?

Sunglasses and your eyes

YOU CAN INVENT BY ACCIDENT

Make a dime fly

Super catch



WHO photo

A Chinese proverb says: "Give a man a fish and he will eat for a day. Teach him to fish and he will eat for the rest of his days." Teaching men to fish is one of the jobs of the United Nations which is trying to develop new sources of protein for over-populated and under developed nations. Here a grouper is being carried to market in India.

SCIENCE DIGEST

Twenty-seventh year of publication

AUGUST • 1963 VOL. 54, NO. 2

Thomas A. Edison with his second wife, Mina. For excerpts from his first pictorial biography, see "Edison in Pictures." Photo: Thomas Alva Edison Foundation.

ARTICLES

TURNABOUT 5
EDISON IN PICTURES 6
DON'T BE ASHAMED OF YOUR DAYDREAMS 14
CHECK YOUR TRAVELING SHOES 21
THE GREAT LIE-DETECTOR HOAX 23
SNAKE ATTACK 30
HOW TO CHOOSE THE RIGHT DIET 32
CITY ON A MOUNTAIN 39
IS SCIENCE ON THE SKIDS? 42
MARK TWAIN SCIENCE WRITER 47
WORLD'S FAIR DINOSAURS 48
PREVIEW OF TOMORROW'S NUCLEAR TERROR 50
BEWARE OF SUMMER GLARE 63
STONES THAT MAKE THE DESERT BLOOM 67
WHAT'S BITING YOU? 69
WILL THIS SOME DAY RUN YOUR CAR? 72
IS ANY ANESTHETIC SAFE? 77
MAKE A DIME FLY 82
THEY LOVE THEIR SWAMP 83
YOU CAN INVENT BY ACCIDENT 87
SUPER CATCH ..... Inside Back Cover

FEATURES

LETTERS 2
HOW DOES YOUR SEAT RATE?—The Progress of Medicine 43
INVENTOR OF THE MONTH—Inventions, Patents, Processes 54
ANYONE CAN UNDERSTAND ELECTRONICS—Your Science ABC's 59
WHAT DO YOU REALLY BELIEVE?—What's on Your Mind? 73
SCIENCE IN THE NEWS 91

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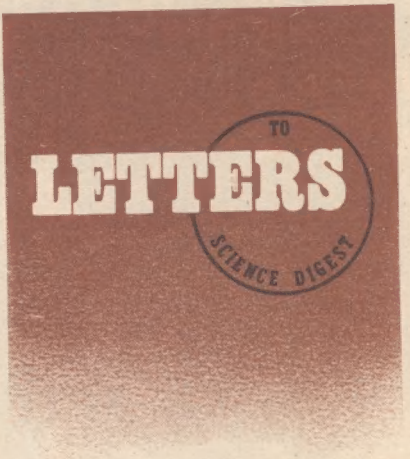


Sick of optimism

I am somewhat sick of typical American optimism ("Henry Kaiser: 'You May Live to Be 100,'" May '63). It is just denying 6,000 years of known human history. For me, Henry Kaiser appears like a child who managed to build a house with a toy building set and now thinks it could build another Tower of Babylon. This Tower will crumble again and for the same reasons. He is forgetting the human mind. I do not refer to the great minds of history, but to the average mind which has always destroyed the great ones.

Has the human mind changed in 6,000 years? How many great minds have we had? How long do real cultures last? What does "progress" mean?

Henry Kaiser can not change the human mind and the eternal laws. If his paradise comes true, it will lead to effeminacy, and no culture or civilization can be maintained by a weakened people. In the United States

effaminacy is a latent sickness right now.

Therefore, please tell our friend Henry that I do not want to live 100 years, it is not worthwhile, as long as the human mind will not change.

W. G. GUEREKE
Caracas, Venezuela

Flash in the pan

I was amazed to learn that a brilliant man such as Peter Kapitsa still believes in Einstein's Special Relativity ("The Man Who Talks Back to Khrushchev" June '63). From my 20 years of optical experimenting, I feel safe in saying that the Special Theory will not survive.

WILLIAM T. THOMAS, JR.
Daytona Beach, Fla.

How many Pharaohs?

In "Behind Cleopatra" (June '63), Daniel Cohen states that there were 32 dynasties in Egypt. I thought there were only 30.

BARRY KRAUSE
Joliet, Ill.

Nekhtharheb, the last of the native Pharaohs, was the last ruler of dynasty XXX. However, some sources count the rule of the Persian conqueror Ochus as dynasty XXXI and the Ptolemaic period as XXXII.
—DANIEL COHEN

Before the flood

I take exception to the statement in "Behind Cleopatra" (June '63) about the Great Pyramid's being built by Cheops. After 15 years of study and research on the Great Pyramid and other very ancient structures, I have found many reasons why Cheops could not have built it.

I realize that all history books credit the Great Pyramid to Cheops due to their unwillingness to accept the possibility of one or more great civilizations' existing before the great flood of 10,500 B.C.

W. C. WHITE
Florence, S.C.

Wilted

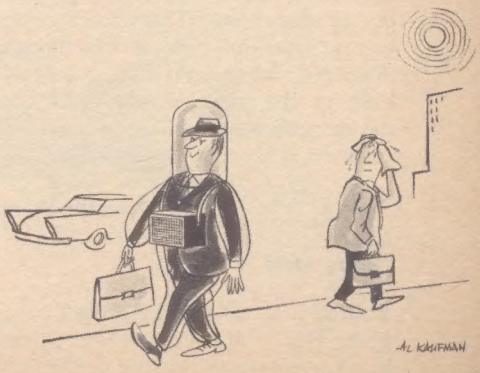
As a resident of the "City of the Angels," I must enter a correction on the spelling in the June issue of one of our main business and traffic arteries. It is not Wiltshire but Wilshire. However, if a pun may be allowed, the traffic sometimes can cause one to wilt!

CHARLES J. RUBEN
Los Angeles, Calif.

Science Digest rushed in where Angelenos fear to tread. Sorry.—EDITOR.

Fast fly

In "Nature's Weirdest Inventions" (May '63) John Sidney stated "the



apex of speed (200 m.p.h.) is probably achieved by the Indian swift." I have read that the little deer botfly of the Southern U.S. and Mexican mountains was clocked by Dr. Charles Townsend at 818 m.p.h. Traveling at this speed, it appears only as a blurred streak.

RONALD H. MAIN
Cranbrook, B.C., Canada

Upward and outward

I disagree with the writer of the letter "Space Age Hysteria" (June '63) which states that the space program is folly. I think the writer is entitled to his own opinion, but I believe that many other sensible people who have their eyes on the future will agree with me. I request you to continue and perhaps expand the printing of space articles.

SID BOTTOMS
Redstone Arsenal, Ala.

Ad not Ab

In "Soviets Use Charcoal to Maintain Low Temperatures" ("Science Around the World," April '63) the words "absorption" and "adsorption" were used: "Charcoal . . . noted for powers of absorption. That is, extremely thin layers of molecules of liquids, dissolved substances, and gases adhere to its solid surface." That is the definition of adsorption, and adsorption is correct.

JOHN ENGEL
Ellsworth, Minn.

Wrong state

Your article "Driving Across Chesapeake Bay" (March '63) was particularly interesting because I live just a few minutes' drive from the new bridge-tunnel. We are very proud of this project, but your magazine has made an error that countless others have. This bridge-tunnel will not span water between Virginia and the Eastern Shore of Maryland, but will reach from the mainland of Virginia to the Eastern shore of Virginia. Few out-of-state people realize that the southern tip of the peninsula between Chesapeake Bay and the Atlantic Ocean is also Virginia, not Maryland!

KENNETH CARPENTER
Exmore, Va.

Wrong track

In your June '63 issue ("The Mental Differences Between the Sexes") you made a mistake. You stated that the stops for the 8th Ave subway are 14th, 23rd, 34th, 42nd, 51st—correction 50th— 59th and 72nd.

Besides looking for mistakes I read your magazine, believe it or not, and find it a very good one.

JOSEPH MAURIELLO
New York City

We always had trouble getting out of the 50th St. station.—EDITOR.

Captivates the interest

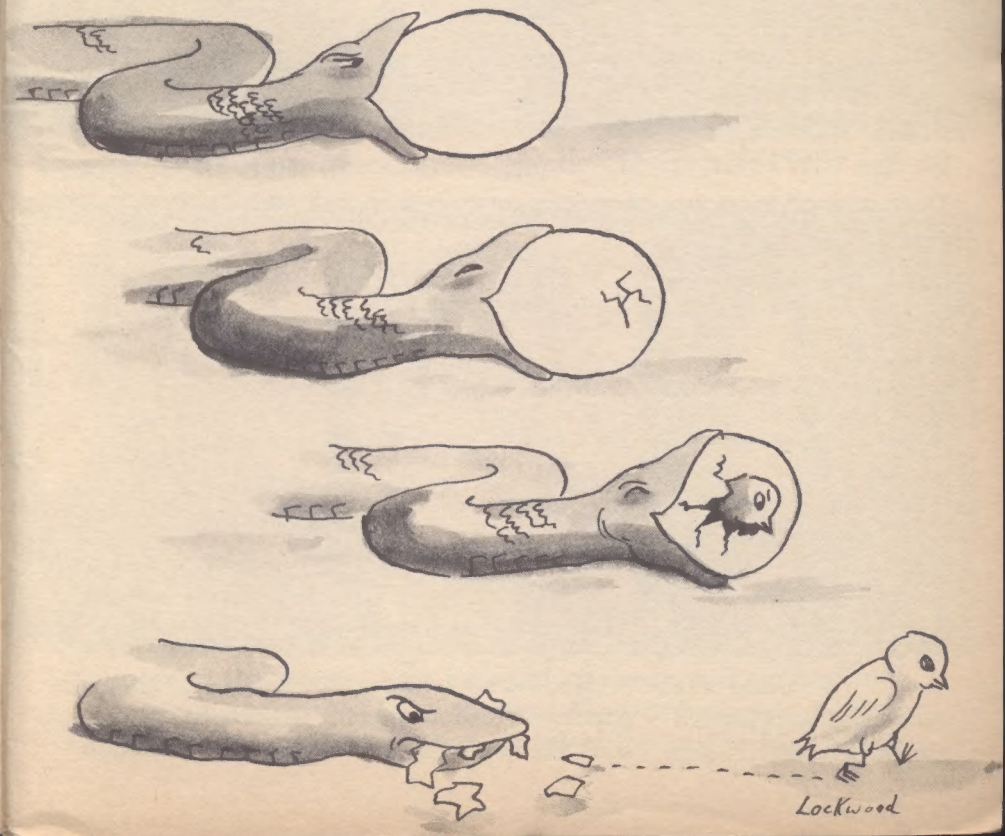
I wish to take this opportunity to express my sincere appreciation of your excellent magazine. I donate each issue of *Science Digest* to our school library. Needless to say, this magazine captivates the interest of both students and teachers in our school. They find it worthwhile and useful in their studies and in their research.

NARCY L. LACSON
Manila, Philippines

Turnabout

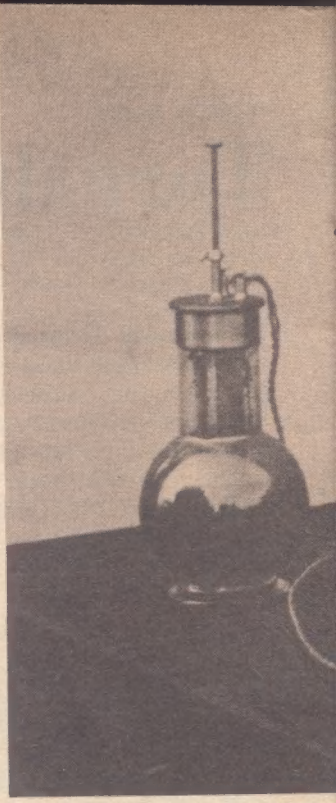
REMEMBER Dasypeltis, the egg-swallowing snake (*Science Digest*, June '62)? Cartoonist Alfred Lockwood, bothered by the injustice of the situation, has given the egg a chance to strike back.

More snake-swallowing tricks can be seen on page 30.



All pictures courtesy Thomas Alva Edison Foundation, except picture of Edison at 16 or 17 below, courtesy of The Henry Ford Museum, Dearborn, Michigan. Excerpted with permission from THE INDISPENSABLE MAN, Shorewood Publishers, Inc., New York, $2.95. © Copyright 1962 by Thomas Alva Edison Foundation, Inc.

Thomas Edison was born 1847 in this house in Milan, O., to an ex-schoolteacher and a Canadian who made shingles.

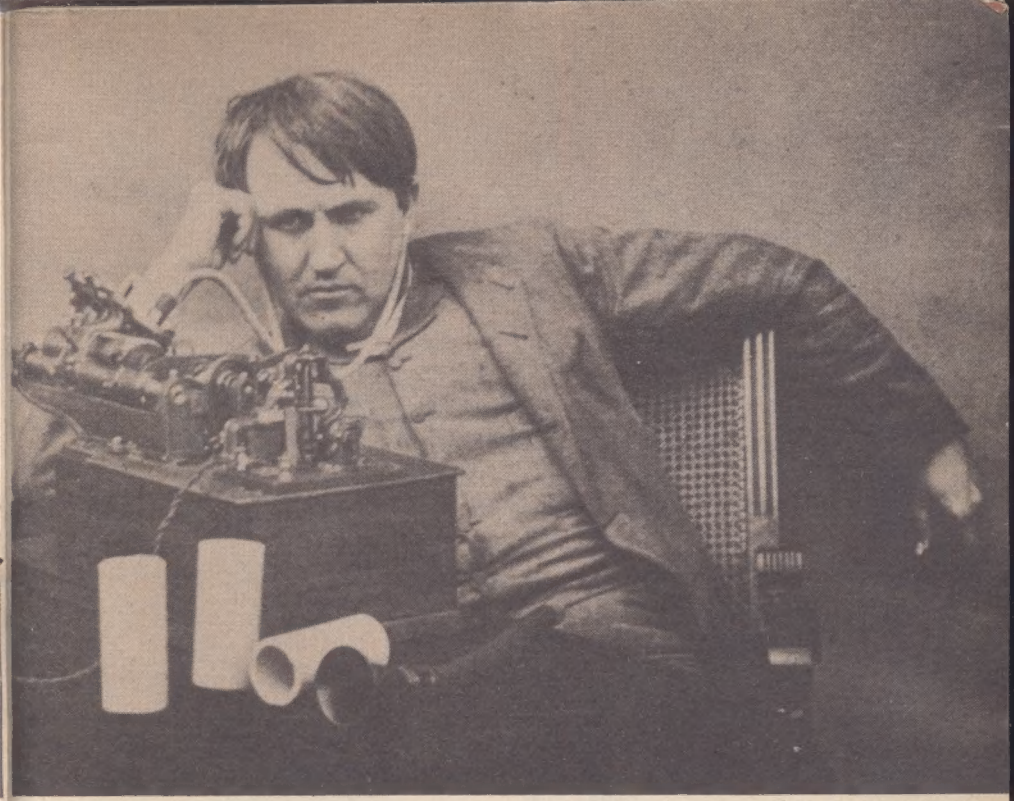


In 1888, he worked 72

At 3, he found life hard. Edisons moved to Pt. Huron, Mich.

At 13, he was selling papers. Mother gave him his schooling.

At 16 or 17, he knew telegraphy, had a job with a railroad.



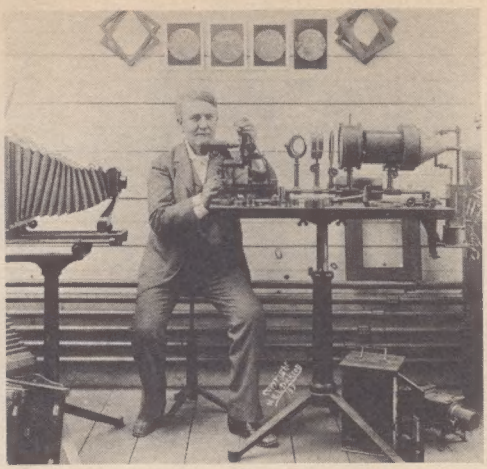
hours nonstop to perfect phonograph. He invented it at age 30.

Edison in pictures

his life, his wives, his work

He was a revolutionary who lit up the night, captured our sounds and actions, and pointed the way for technology. He was also a deeply human man. Here is Edison's story as told in photographs from his first pictorial biography.

He and an assistant thrilled Washington with his phonograph. President Hayes kept him up till 3:30 a.m.



In 1893, he experimented with this microphotography equipment. But he was best known for his work with electric light. He took out 356 electrical patents.

Thousands visited his West Orange, N. J., lab, even a band.

This movie projector developed from experiments as far back as in 1889. Edison took out 1,093 patents during his lifetime.

He brought pictures to life

Early movie cameras recorded this scene from Edison film "The Kiss." A few first films had sound.

Cor Ave B & 17th St
New York Sept 30 1885

My Dear Sir

Some months since, as you are aware, I was introduced to your daughter Miss Mina. The friendship which ensued became admiration as I began to appreciate her gentleness and grace of manner, and her beauty and strength of mind.

That admiration has on my part ripened into love, and I have asked her to become my wife. She has referred me to you and our engagement needs but its confirmation your consent.

I trust you will not accuse me of egotism when I say that my life and history and standing are so well known as to call for no statement concerning myself. My reputation is so far made that I recognize. I must be judged by it for good or ill.

I need only add in conclusion that the step I have taken in asking your daughter to intrust her happiness into my keeping has been the result of mature deliberation and with the full appreciation of the responsibility I have assumed and the duty I have undertaken to fulfill.

I do not deny that your answer will seriously affect my happiness and I trust my suit may meet with your approval.

Very sincerely yours

Thomas A Edison

To Lewis Miller Esq
Akron
Ohio

He asks for his second wife's hand

When he was 24, Edison married Mary Stillwell, an employee of his laboratory in Newark, N.J. Five years later, he moved to his famous lab in Menlo Park. But after Mary died in 1884, he set up shop in West Orange and never returned. The father of three, he married Mina Miller, an inventor's daughter, in 1886 after a formal courtship (see the letter to her father above).

◀ Mina Edison visits his lab. She tried to smooth his rough ways.

With second wife he became father of three more children.

In later years, Edison enjoyed excursions with (left to right) Henry Ford, President Harding, Harvey Firestone.

In possibly the only picture of someone sleeping before a President, Edison naps as Harding and Firestone chat.

In gag picture with Edison, Ford poses as a Western bad man. The auto manufacturer had met Edison in 1896 and won encouragement for his gasoline engine. Later, he moved Edison's abandoned lab at Menlo Park to Dearborn, Mich. This preserved for posterity the world's first organized research laboratory.

In 1931, he checks an experiment. He died the same year.

What was Edison's legacy to us?

David Sarnoff, chairman of the board of RCA, met Edison in 1928 and recalls a placard that hung on the lab wall: "There's a way to do it better—find it." In Sarnoff's words, Edison's "greatest invention, the one most productive and most instructive for our times, was not a single piece of equipment but a unique *method* of innovation. For it was Edison who first conceived the idea of assigning teams of gifted workers to 'find a way to do it better.' In systematizing the quest for new knowledge, he became the father of modern research."

But that isn't all:

"Edison's message for our time is that we must work as a team but we must not lose our sense of the uniqueness of man's genius, of the supreme value of the individual."

Above all stood Edison's thoughtfulness and strength of character. He once said:

"The man who doesn't make up his mind to cultivate the habit of thinking misses the greatest pleasure in life. He not only misses the greatest pleasure, but he cannot make the most of himself. All progress, all success, springs from thinking." And he added: "I never allow myself to become discouraged under any circumstances."

P.I.X. Photo

Your waking musings aren't just a waste of time. They can often work for you—to meet the stress of life and even solve problems. However irrational and embarrassing you think your daydreams may be, nearly everybody else has them too.

Don't be ashamed of your daydreams

by Fritz Leiber

A BORED and weary office worker imagined his boss and his fellow slaves, male and female, all sitting at their desks in bathing suits. This comic scene, known only to him and glimpsed only for a few seconds, brightened his mood and restored his efficiency.

A woman, troubled and frightened by newspaper reports of desegregation troubles, was transported in fancy to a park in a strife-torn city where angry opposing mobs were about to riot. She got their attention, and delivered an address on brotherhood which made them understand each other and averted the catastrophe. This hidden impossible heroism calmed her own feelings and incidentally made it easier for her to speak her mind on the racial question the next time it came up in conversation.

A young man tossing in the after-midnight dark unable to sleep, pretended that he had the power to levitate: to move through space without effort, defying gravity. He floated out through the bedroom window and swam above the dark streets. Soon he rose higher and was orbiting the earth, while he surveyed the continents and seas below. This fantasy relaxed his muscles, refreshed his geographical picture of the world, and—perhaps because sleep as we experience it is a kind of dark floating—eventually put an end to his exhausting wakefulness.

These three people were all using with pleasure and some profit the wonderful story-creating powers of the human mind, which never rests from birth to death any more than the living heart stops beating, and yet—fortunately for us— cannot always be engaged in constructive realistic grappling with the problems of the outside world.

The three daydreamers were tapping the stream of thoughts, images and feelings that courses through all our minds during every sleeping and waking hour, instead of letting it flow by in unconsciousness. They were making use of the universal human power to create fantasies.

Unwilling to confess

Laurance Shaffer and Edward Shoben, Columbia University psychologists, systematically studied the daydreams of 390 normal college people, using anonymous questionnaires and other encouragements to complete honesty. (The psychological novelist Robert Bloch recently pointed out to the author that most of us are even more unwilling to confess our daydreams than our night dreams, as if we felt we could be held responsible for the former but not the latter.)

When the results were in, the Columbia psychologists discovered that all 390 subjects daydreamed—daydreamed naively, irrationally, absurdly by common-sense standards—and that 9 out of 10 had certain pet daydreams over and over —something that was once looked on as a symptom of mental trouble.

The most popular topics for daydreaming turned out to be money,

Daydreams spring from the unceasing activity of the human brain: the repeated, restless switching on of mental and sensory circuits.

PIX Photo

possessions, job success, and sexual conquests. More than 19 out of 20, men and women alike, enjoyed personal fantasies of all those four sorts.

In fact there was relatively little difference between the daydreams of the men and the women. The former led, but not by so much, in daydreams of astonishing muscular feats, life-saving, and living in kingly grandeur. The girls were a little ahead—but only a little!—when it came to daydreaming about possessing great physical attractiveness and performing amazing mental feats.

Although most of the daydreams owned up to were enjoyable, not all were so by any means. Nine out of ten of the subjects had occasional mental fantasies of a worrisome fearful sort; almost half the collegians sometimes fantasized about the death of others and more than half about being misunderstood and abused.

Going on now from these rather standard fantasies—and they seem stereotyped only because the method of tabulation and pigeon-holing makes them look that way—we find that daydreams cover an almost infinitely wide spectrum, from the simple imagining of the small child that he has found a treasure of chocolate bars under his bed to the weirdest and most gorgeous wonders. Here is one of the latter, reported by an intelligent, neurotic-but-normal patient of the Swiss cofather of psychoanalysis, Dr. Carl Jung: it is an example of the strange-vision sort of fantasy that sometimes invades even the most rational mind:

A magician is demonstrating his tricks to an Indian prince. He produces a beautiful young girl from under a cloth. She is a dancer, who has the power to change her shape. During the dance she dissolves with the music into a swarm of bees. Then she changes into a leopard,

then into a jet of water, then into an octopus that has twined itself about a young pearl-fisher. Between times, she takes human form again at the dramatic moment. The prince is beside himself with delight and calls her to him. But she dances on, now naked, and even tears the skin from her body, and finally falls down—a naked skeleton. This is buried, but at night a lily grows out of the grave, and from its cup there rises a white lady, who floats slowly up to the sky.

Some normal people have extra fantasy-making mechanisms built into their minds. For instance, about 15 percent of us hear sounds and words also as colors: for such a person a soprano's high tones may be strawberry-hued, a cow's moo wine-colored, the word "susceptible" might be China white, edged with green, "virgin" midnight blue shading to cream color. All these are actually-reported instances of synesthesia, as it's called, attested to by such psychologists as the British pioneer Francis Galton.

The color of words

A synesthetic person studied by Dr. L. B. Alford, Boston State Hospital pathologist, declared, "Words incorrectly spelled always have the wrong color." A most useful trick, that one!

Many daydreams, however, simply gild with a sense of breathless wonder daily happenings that might otherwise seem commonplace: a woman bakes a cake and gets a feeling of satisfaction which has been compared to motherhood; a boy plays cowboys and conquers the frontier; a great-grandmother sits out her old age in happy recollections; a man falls in love with a woman and sees in her all the beauty of the world.

Daydreams spring from the unceasing activity of the human brain: the repeated, restless switching on of mental and sensory circuits that keeps up in the absence of ordinary stimuli and conscious thinking.

Seeing in the dark

One test of this that anyone can make is to go into absolute darkness—head under covers and eyes lightly shut at night, or the like. In spite of the total absence of visual light, you see shifting colored specks or a faint luminous mist—the cones and rods of the retina of the eye have kept on firing in a random minimal way, and some of the circuits of the brain's visual area are firing too.

"Eyes *lightly* shut" is emphasized because any pressure, such as a soft finger-touch on the shut lids, will bring additional color sensations.

Sometimes the randomized mists of "lightless" colors will fleetingly take the form of landscapes and figures and faces: another aspect of the mind's fantasy-creating power.

It is the same with the other senses. In a soundproofed anechoic chamber, one still hears, as from a seashell, a faint unceasing murmur of sound: the beat of the heart and

the rushing of the blood plus a random firing of the auditory circuits which keeps the hearing-machine warmed up.

Likewise the half million touch detectors and three and a half million pain detectors never shut off altogether. Body and mind swim in a sea of sensation that forever ripples faintly at least, never grows wholly calm.

As with the senses, so with the brain. The countless circuits set up among its 13 billion nerve cells never wholly stop firing. Even in deepest sleep, the electro-encephalograph detects several varieties of brainwaves caused by the brain's electrical activity.

Viewed from the inside, this unceasing electrical pulsing means an unceasing flow of sensation, feelings, images, ideas, so ghost-faint that they do not wake the sleeper or even intrude strongly into waking consciousness.

The great unconscious river

Yet they are there: the great, dark, ever-flowing unconscious river of which we become partially aware in r e v e r i e s, night-dreams, daydreams, meditations, and other creative and appreciative mental activities.

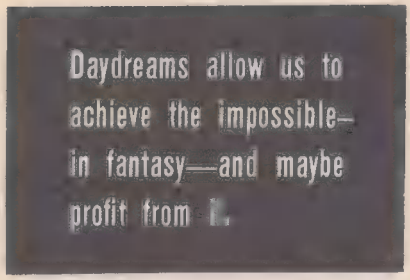
The brain may idle, like the motor of an automobile at an intersection, or like the circuits of a computer warming up, but it never stops. In fact, the brain expends almost as much energy in idling as it does in working at top capacity. The frequently quoted statistic that it takes only the energy of a half peanut to do two hours of mathematical calculations means that this is the difference in energy consumption between the brain idling and the brain doing arithmetic.

Actually the caloric energy of between 30 and 40 peanuts would be needed to supply the brain in either case for two hours of functioning. For the human nervous system is prodigal in its energy consumption whether busy or at rest, taking for its maintainence 25 percent of the oxygen we breathe and a like quarter of the food we eat.

How the nerves rest

How is such unceasing activity possible? It may be that the nerve cells and circuits of the brain get their rest in much the same way that the heart rests between beats. Donald B. Lindsley, UCLA psychophysiologist, points out that the channels leading from the senses to the brain shut off and then turn on again several times a second, rather like the shutter of a motion-picture projector. This allows the mind's inward attention to shift from one picture to the next without blurring and likewise provides rest periods for the nerves.

Adult daydreams don't just press the pleasure-button in our brains; they also have constructive elements. They enable us to *explore* lines of behavior in fantasy before trying them out in fact. They allow us to achieve the impossible—strict-



ly in fantasy, of course—and sometimes profit from it. Once again, let us look at a few representative adult daydreams:

An artist gets an image of the great German composer Beethoven coming into his room and discussing with him their artistic and personal problems. In this sort of daydream, anyone can achieve a sometimes inspiring and enlightening contact with the great.

A housewife imagines a sympathetic character in a TV soap opera analyzing her neighbors and even herself. The comments tend to be somewhat shrewder and more objective than if she had not projected them in this way. Any device whereby a person can get out of himself and view things from another and preferably larger viewpoint is helpful.

A businessman who did not cut too brilliant a figure at a conference earlier in the day imagines himself giving the answers he should have to the objections and criticisms his ideas received. This leads to him imagining a little speech in which he outlines and clarifies his position. In subsequent daydreams, he improves and polishes this speech, and at a later conference he actually delivers it in part.

An aloof, irritable person with a talent for saying the wrong thing has fantasy conversations where everything goes smoothly, mutual understanding is achieved, and his customary tactless remarks don't come out. This person has discovered a way to practice behavior which may eventually build up to a change in outward personality.

Even the unhappy, wistful or worrisome sort of daydream generally has a positive side. The waking fantasy in which we return to a critical moment in our past life and make another and, in retrospect, wiser decision than the one we in reality made—choose another educational course or profession, snatch at some opportunity we turned down at the time, pick another marital partner—is one more kind of private experiment. If we are honest about this sort of exploration of past possibilities, we may be able to distinguish and own up to our true past cowardices and errors of judgment and be better prepared for situations arising in the future.

A dream of help

Persons with developing neurotic problems, alcoholism and the like, frequently daydream of getting a job in a mental hospital. It is their way of breaking gently to themselves the news that they need psychiatric help. It also represents an early awareness of how they may benefit from seeking to learn from

and help those who have problems similar to their own—the group therapy concept. In two cases known to the author, the person actually did get such a job, one as a psychiatric aide, the other as a clerical worker in a mental hospital. Both benefited.

Daydreams can be the beginning of artistic creativity—writers and other artists are, or ought to be, expert daydreamers—or even of scientific insights: the German chemist Friedrich Kekule solved the mystery of the structure of the benzene molecule in a daydream; he saw its six carbon atoms dancing not in a line but in a closed ring—something no one had imagined before.

Reveries that give strength

Daydreams can also take the form of reverie—the review of the best moments in our lives, the experiences that give us the strength to go on living and that are guideposts for the future; not so much the moments of pure triumph and success as those in which we had greater insights, a stronger fellow-feeling for other living beings, and in which we knew a widening of inward horizons.

Daydreams of this sort can merge into spiritual meditation, in which a person is no longer chiefly guided by his own desires and urges, but goes outside himself, sees in imagination the desires of others as well as his own, tries to put himself in the minds of others and see things from their viewpoint too.

How can we get the most out of our daydreams? The question verges on the ridiculous. Certainly we can't control them like mental puppetry. Daydreaming is like sunlight; we can't control sunlight, but we can expose ourselves to it in moderation and be benefited.

Sweetening the unconscious

We know that it helps to feed the mind scenery, books, human contacts, reality-jewels of all sorts. That way, the waters of the unconscious are enriched and sweetened—and our daydreams too.

We also know that it helps to daydream in the widest possible spirit, thinking of others besides ourselves, opening ourselves to the whole world, not seeking to control but following where fancy leads.

While we can't say it is always good to daydream—it isn't!—still, the river of feelings and images is flowing steadily past whether we like it or not. And it pays from time to time to dip into it.

It may well be that regular escape into reverie is part of the answer to the feverish, competitive pace of modern living.

❧ ❧ ❧

ANTARCTICA is a waterless land. Annual precipitation on the vast interior plateau is equivalent to only four inches of rain, merely two more than that of Death Valley, the *National Geographic Magazine* says. The continent's potential water—equal to all the world's rivers and lakes—is locked in snow and ice.

Check your traveling shoes

by Ruth Boyer Scott

THIS is both an easy and a difficult year to shop for shoes for your vacation.

For men, the perforated tops add better ventilation, which means more summer comfort.

For women, the lingering fad of pointed toes has crippled many stylish feet. But the various types of rippled rubber soles are proving the answer for that "all-day walking tour."

Whatever your sex or age, a minimum shoe wardrobe for a trip (from overnight to a year's slow trip around the globe) should consist of two pairs of shoes and one pair of rubbers. An unexpected rainstorm, a quite-unplanned loss of a heel: these are but two of the emergencies that make two pairs of shoes common sense even with the lightest baggage.

For children, the shoes might consist of one pair of leather tops and one pair of canvas tops. Even co-eds like to pad around in sneakers, if they are accustomed to low heels, or heellessness.

But that's quite a big "if."

Remember, your heel tendon shortens with the wearing of higher heels, and will ache quite annoyingly if you make a sudden plunge to flats. Stretch your tendons and muscles slowly, and well in advance of a trip, if you contemplate a drastic change in heel height. Otherwise your attempt to make walking easier might accomplish the reverse.

Women will find that a store's teen shop provides dress shoes with more comfortable toes and accident-proof heels than the typical lady's shoes shop.

In buying vacation shoes, consider a shoe that is wider and longer than your "sitting down" shoes for the office. A couple of useful gadgets to know of are the sponge-rubber heel wings which are self-adhesive to prevent a heel from slipping; and the similar "tongue pads" which will adhere on the underside of the tongue of an oxford. By thrusting the foot backward, they help to prevent heel-slipping.

But for emergency wearing of new shoes, stop right now for the least soreness, and put a Bandaid

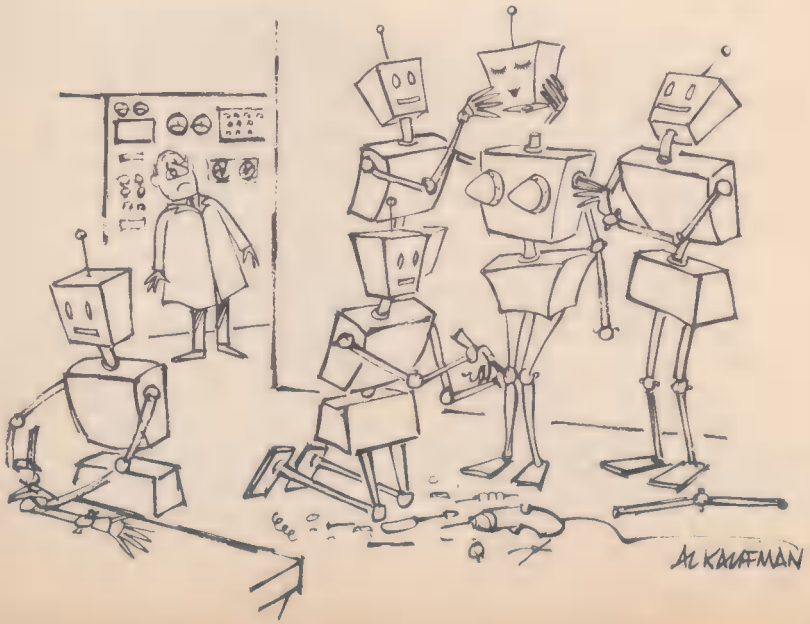
or a piece of adhesive over the red spot. Better still, apply adhesive tape to any familiar spots of difficulty before the warning soreness threatens. Remember, if you reach the blister stage, that a broken blister is an open wound and should be treated with surgically clean care.

Rubbers vary from the little toe rubbers in a bag which a woman may carry easily in her raincoat pocket, through the various standard rubbers to the tall waders of the fisherman. What do you need?

If your packing limitations are severe, men can eliminate their bedroom slippers, using the alternate pair of walking shoes. Women, already equipped with one pair of dress shoes and one pair of walking shoes, might debate the merits of a pair of sandals. They may serve for bedroom slippers, for a spare for walking, and for those purse-carried comforts to slip on during a long plane, train, or bus trip. If you wear them after swimming as beach shoes, do dry off as much as possible first. The rundown from a bathing suit tends to make them pulpy. They won't last long if you substitute them for shower clogs.

Incidentally, some tricky shoe bags can be carried on the feminine arm so that a woman can pop on dressy heels for dinner, after wearing walking flats all day for sightseeing.

Of your whole travel wardrobe, shoes are an essential key to happy traveling. Choose them with the care they deserve.



The great lie-detector hoax

by Bruce H. Frisch

Today the lie detector is used not just on criminal suspects. Already thousands of Americans must submit to it to get jobs, or keep them. Here are the facts about this machine that would brand your word the truth or a lie.

Pens trace three body changes on moving paper as Joseph Campbell, criminal polygraph examiner for the city of Paterson, N. J., demonstrates good technique on psychology student Eugene Guberman.

THE phone rang in the Pentagon office of Deputy Secretary of Defense Roswell Gilpatric. This was the Air Force Inspector General. Someone had leaked an Air Force memorandum to the press, and he had been ordered to find out who. Would the Deputy Secretary agree to take a lie-detector test? He would.

Air Force Secretary Eugene Zuckert said he would too. And so would Navy Secretary Fred Korth. But Arthur Sylvester, Assistant Secretary of Defense for Public Affairs, and Charles Hinkle, the Pentagon's security review chief, both refused.

Then Defense Secretary Robert McNamara stepped in. He cut off the investigation and thus ended one of the gaudier sidelights of the Senate inquiry into the TFX fighter-plane contract.

No one ever actually took a lie-detector test. It was never intended that they should, the Inspector General explained; he just wanted to see who would not agree to take one. But the incident threw a sharp focus on an instrument about which much is said and little is known.

What is this device for bluffing

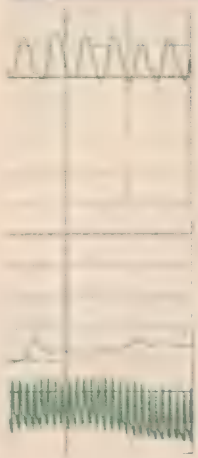
When you take a lie-detector test, three measurements are recorded. Rate of breathing is measured by a rubber hose around the chest, and is recorded as the top line on the graphs below. Galvanic skin response (GSR) is measured by two electrodes on the hand and is recorded as the center graph line. An arm cuff measures blood pressure, which is represented by the third of the machine's tracings.

Is he lying?

high government officials? Is it so accurate that they should trust their careers to it? Is it so discerning that bank clerks and salesgirls should be subjected to its scrutiny as thousands of them are? And what of the moral issues involved in this instrument that would brand a man's word the truth or a lie?

The lie detector has been attacked by such diverse persons as Pope Pius XII and J. Edgar Hoover. Pope Pius' moral condemnation reflects the European attitude. In West Germany the lie detector has been declared unconstitutional. Elsewhere on the continent and in Britain, police have little interest or confidence in the machine.

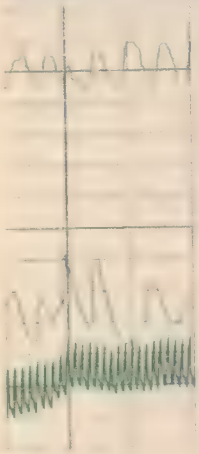
In the United States, where the lie detector originated, such reservations are less common. Forty-two years of police experience here have shown that a lie-detector test can give reasonably accurate results—when given by qualified examiners, to certain people, under the right conditions and in certain kinds of cases.



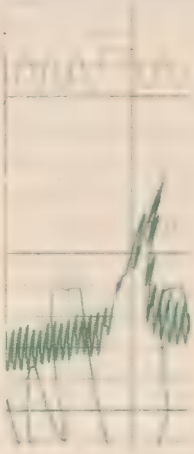
Note the smooth, regular breathing shown by the top tracing. Galvanic skin response (GSR) on the second line hardly quivers. Along the third line, blood pressure remains relatively level. Eugene is telling the truth on this question.

The trouble is that there are only a few good examiners, and some organizations try to use the lie-detector for jobs it just can't do.

The machine itself is simple. All it does is record on a graph blood pressure and pulse, breathing and the skin's electrical resistance (a



The third breath is repressed, and the following breaths are deeper to compensate. GSR fluctuates wildly, but Campbell decides this was caused by body movement. The rise in blood pressure is a second giveaway. Eugene is lying.



Eugene catches his breath, but zooming blood pressure betrays him. He is tensing his left arm, trying to fool the lie detector. Criminals often try to create tension unseen by wiggling their toes. (All photos by Bruce H. Frisch).

factor said to be related to sweating). These three tracings give the lie-detector its other name, polygraph.

For blood pressure-pulse measurements, the subject wears a blood-pressure cuff like the ones physicians use. A rubber hose connects the cuff to a metal bellows linked to a pen. As the artery in the upper arm pulses against the cuff, the bellows expands and contracts, sweeping the pen over a moving strip of graph paper.

Around his chest, the subject wears a short length of expansible rubber hose to record breathing movements. This is done with the same type of mechanism as for blood pressure-pulse.

Two electrodes on the hand pick up galvanic skin response. The strength of a small current passing between them is a measure of the skin's varying electrical resistance. Increased perspiration lowers the electrical resistance of the skin, although there are conflicting explanations of just exactly what the GSR (galvanic skin response) measures.

No room for surprises

To begin the lie-detector examination, an investigator asks a dozen or so questions which he has already shown to the subject, in order to allow for the surprise element. Surprise can confuse the machine's results. The examiner may repeat the list of questions several times to get a consistent pattern on the charts. Then he checks the charts for indications of body changes.

Many examiners count on blood pressure-pulse most and GSR least. Some discount GSR completely as too sensitive for tense situations, while others insist on getting a positive indication from all three traces. All agree GSR is useless alone except for such relaxed studies as the measurement of interest level in TV programs.

The theoretical connection between these various readings and the detection of a lie is that emotion can cause physical changes. When we become fearful or angry, the blood vessels leading to the stomach and intestines contract, and those leading to the exterior muscles dilate, thereby diverting more blood to the exterior muscles and preparing them for action. At the same time, the heart beats harder and faster, so blood pressure rises. Normal breathing is disturbed and more perspiration pours from the sweat glands, lowering GSR resistance. There are also many other emotional changes the lie-detector does not monitor.

While bodily changes registered on the lie-detector may indicate emotions, they do not indicate which emotions. Psychologists can't tell one from another without other clues. Yet the lie detector operator must assume that a change indicates a specific emotion, fear of being detected in a lie. The fact is that confusion, misunderstanding, anger or a shift in attention can also cause reactions. According to the American Psychiatric Association, "feelings of guilt may be latent and not refer to the case in hand at all."

Not likely candidates

Another drawback is that many people cannot be effectively tested under any circumstances—psychotics, idiots, imbeciles, drug addicts, alcoholics, diabetics, and persons with heart and lung ailments.

An Army instruction manual also rules out highly nervous or excitable persons, and goes on to warn about temporary conditions which interfere with clear results—colds, coughing spells, asthma, hiccups, hay fever and other allergies.

A person must know he is telling

"Whenever the human element enters into an interpretation of anything, there always is variance."

a lie before he can show it. Unless a person has a well developed sense of guilt he will give no reaction. Psychopathic liars are unable to remember what is true and what false. Some otherwise normal persons may be able to persuade themselves they were completely justified in killing a nagging wife or embezzling from a rich employer. So they feel no guilt, and have no reaction that can be measured on a polygraph.

A test is also impossible without full cooperation. The least muscular tension is enough to raise blood pressure and give a false reaction. Practically, as well as legally, a person cannot be forced to take a test. Yet surprisingly, most people readily agree to taking one when asked.

There are a whole list of blunders an examiner can commit: bullying; arguing with or irritating the subject; asking about sex life, which is almost guaranteed to get a response from anyone; testing in distracting surroundings; having other people around.

The examiner's questions must be clear. If they aren't, he may get an answer to a different question from the one he thought he asked. For example, a subject may be really worried about an undiscovered, more serious crime than the one under investigation and thus not react to the questions.

With all these pitfalls, the part played by the machine shrinks and the part played by the examiner becomes all important. J. Edgar Hoover has warned, "The name [lie detector] is a complete misnomer. The machine used is not a lie detector. . . .The person who operates the machine is the lie detector by reason of his interpretation. . . . Whenever the human element enters into an interpretation of anything, there always is variance."

But a good polygraph man is hard to find. Of the approximately 400 examiners, one professional polygraph operator estimates, "80 percent are either incompetent or outright frauds."

Knowing the subject

Analyzing the traces is a hard job for the best examiners. Ideally, correct interpretation calls for a full picture of the subject's background. The American Psychiatric Association says, "The lie detector may prove valid only in the hands of thoroughly trained psychologists and sociologists who will also evaluate the data derived from the application of other methods and independently obtained evidence." In real life, an examiner doesn't have such guidance, and may himself know nothing about the persons he tests.

Police use the lie detector to elim-

inate innocent suspects, uncover false charges and to extract confessions. Confessions are necessary because, taken alone, a lie detector test is worthless legally. Courts rarely admit one as evidence. When such tests have been admitted, it has usually been after both sides agreed to it in toss-up civil cases where there was little at stake. In getting confessions, police have working for them what one examiner calls "a compulsion to confess." The lie detector gives the suspect an additional psychological nudge in this direction.

The fear of discovery

Government and business use the lie detector for security checks, preemployment screening, to investigate specific losses, and for mass periodic fishing expeditions, which they hope will put the fear of discovery into their dishonest employees. Often the questions are not the sharply defined ones for which the lie detector is best suited, but probe into vague areas like political leanings, sexual tendencies, possible grounds for being blackmailed, future intentions of staying on a job and expected loyalty toward an employer.

Here there is no legal requirement for proof. A simple reaction on the test may be accepted as grounds for refusing a job or security clearance. In some cases, refusal to take the test is considered damning enough.

A simple reaction on the test may be accepted as grounds for refusing a job or security clearance.

Through the threat of mass periodic testing, the lie detector is used as a psychological weapon.

A department store may put half its employees on the lie detector every six months and ask, "Have you stolen anything from the store?" Pilfering goes down and the store is happy. They don't care how accurate the tests are, they just want the employees to know the test is coming and be afraid of it.

Thus, seemingly cut and dry decisions about hiring and firing, or granting security clearances are made on extremely uncertain evidence, and a team of two psychologists and a graduate student warned business men so in a recent issue of the *Harvard Business Review*.

In this light, claims for as high as 95 percent accuracy appear wildly exaggerated, especially when no good statistics on accuracy are available. Under carefully controlled conditions, an investigator for the National Research Council got only 70 percent accuracy.

What are the chances for improvement and regulation? Kentucky and New Mexico have licensing laws now. One awaits Governor Nelson Rockefeller's signature in New York, and four other states are

considering them. Better examiners support such laws to protect themselves against their less competent fellows.

A glaring weakness

Typically, an examiner must be a graduate of a recognized school and must have conducted a quota of examinations. A glaring weakness is the prevalent "grandfather clause" which would allow those previously active to continue in business.

Lie-detector research was almost nonexistent in the past. More could result from a proposal by Dr. Jerome Weisner, Presidential science advisor. He would use the lie detector as one way of checking compliance with a disarmament treaty. But first he wants research to perfect a more reliable technique.

Many people find it hard to find fault with the lie detector because it's an easy as a ouija board and much more impressive. By using it they tend to persuade themselves it isn't necessary to search for real evidence.

But once people realize that neither the machine nor the so-called expert examiners are infallible, they will lose their awe of the lie detector. Then, the Harvard team warns, the game will be up.

Is migraine a myth?

AT LEAST 60 percent of man's unexplained pain—including "migraine" headaches—is due to a flaw in the complex human system of bones and muscles, a veteran of 38 years of surgical practice contends.

"I have come to believe that 'migraine' is a condition which does not truly exist," says Dr. Wayne Bronaugh of Belpre, Ohio.

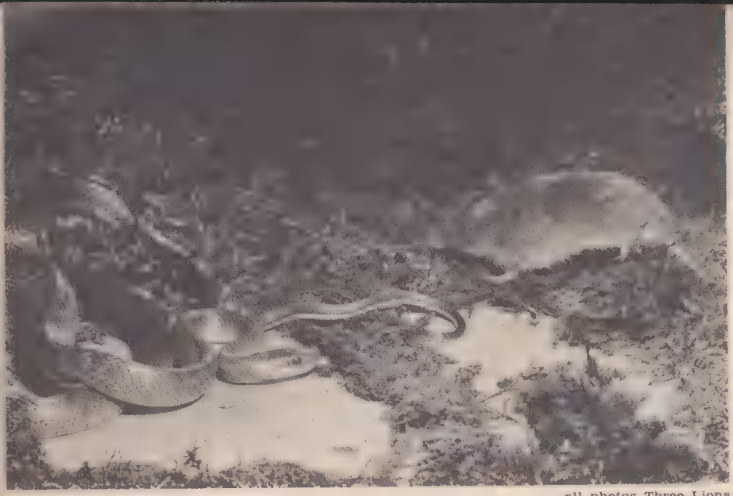
Because of faulty mechanics of the musculo-skeletal system, many patients undergo needless surgery each year or are dismissed as neurotic by their physicians, Dr. Bronaugh believes.

After using a treatment on a patient's skull Dr. Bronaugh reported, "During the past five years every patient whom I had previously treated for migraine headaches has been cured; and no patient with severe headaches has failed to secure relief."

At least 95 percent of all headaches not due to tumors are caused by loosening or stretching of the large ligaments that attach to the base of the skull and control the motion of the head, he says.

A small number of mechanical conditions, he adds, also account for at least 60 percent of all arm, chest, abdominal and pelvic pain as well as pain in the back and legs.

"It is common knowledge," he reported, "that thousands of patients are treated for coronary insufficiency or occlusion . . . when the heart has always been a normal organ. There are numerous patients in the world today suffering from pain, the cause of which is not clear to the doctor, who are usually labeled as neurotics."



all photos Three Lions

Tensed and ready for the attack, a hungry aesculape snake prepares to catch a mouse in the grip of its muscular coils.

Snake attack

Most people are afraid of snakes.

Probably no aspect of snake lore is more chilling than the tales of pythons and boa constrictors, the giant constricting snakes of South America and Africa. But Europe has its own miniature version of these reptilian stranglers—the aesculape snake.

Despite the apparent viciousness of its attack, the aesculape snake is really more humane than other nonpoisonous snakes of Europe. It kills its prey before eating it, thereby sparing the victims more agony than necessary.

Like the giant constrictors, the aesculape kills by squeezing its prey to death.

To catch a field mouse, the snake moves with great speed, enfolding its victim in the deadly pressure of its coils.

Before swallowing, the snake searches for the mouse's head. The animal must be swallowed head first for if it were swallowed against the grain of the fur it would be impossible for the snake to get so much bulk through the narrow passage of its throat.

As it swallows, the snake holds the mouse in a stationary position with its coils, and then literally pushes and twists itself over the prey.

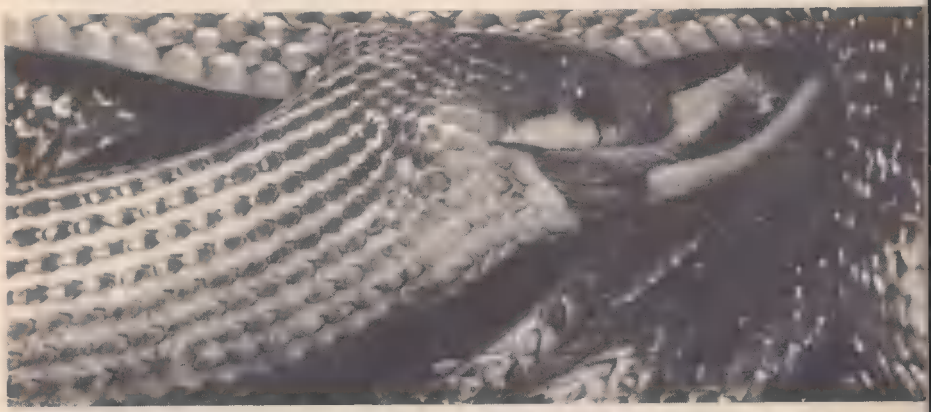
Highly expandable jaws and a strong but flexible digestive tract allow the aesculape snake to engulf the mouse, which is actually larger in diameter than the snake itself.

This swallowing is not an easy task. After feeding, the snake is exhausted and is in great danger from attack itself.

No three-square-meals-a-day eater, the snake takes its time excreting powerful digestive juices to dissolve the mouse, and a considerable period elapses before it is hungry again.

The powerful coils of the snake bring a quick and relatively merciful death—saving the mouse from the suffering of being swallowed alive.

Head first is the way the snake must swallow so large a morsel without choking.



Writhing and twisting, the snake literally pushes itself around the dead mouse which is held stationary by the coils.

Exhausted and gorged after the difficult task of swallowing a meal wider than itself, the snake now is ready for a long rest.

HOW TO CHOOSE THE RIGHT DIET

by Willetta Bar-Illan

"Miracle" diets come and go, but the fat American goes on and on. Perhaps all the good advice the overweight are getting is not really so good. There is only one way to take off the pounds and keep them off. Here it is.

Most reducing diets are bunk. Not only are they worthless, they are often physically and emotionally harmful. And, while usually staying outside the legal definition of fraud, they are outrageously and unscrupulously misleading.

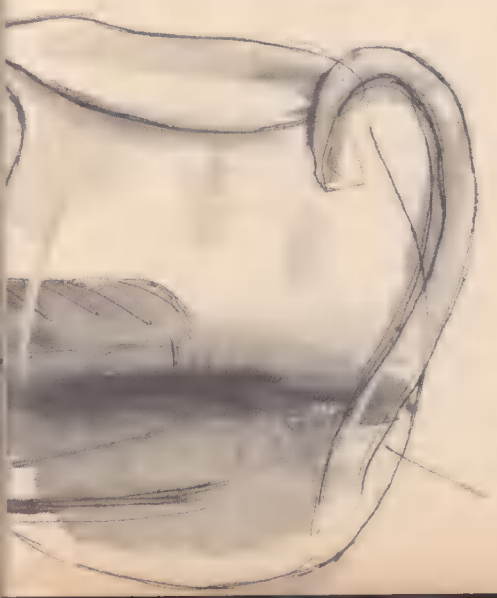
The variety of these diets is staggering.

They range from a can of liquid in lieu of a meal, to intricate recipes of minutely calculated down-to-the-last-calorie gourmet concoc-

tions; they may promise you will lose ten pounds in five days while "eating to your heart's content" (as long as you supplement your diet with a product which happens to be marketed by the diet-pusher), or they may assure you of shedding forty pounds (the woman in the accompanying picture did it!) by following an "easy, nourishing, satisfying regimen" which features generous quantities of boiled carrots, grated celery and scintillating sauerkraut cocktails.

But there is one thing most of these diets have in common: In the long run they will not make you lose one solitary, miserable ounce.

And worse: in most cases they are absolutely guaranteed to cause an increase in your weight. As the late Dr. Norman Joliffe of the New York City Dept. of Health put it, "At least 90 percent of all the people who lose weight on a diet proceed to gain it right back, and usually they gain more than they lost."



The reason is simple. Dieting is usually a harsh trial for dieters, and to compensate for the sacrifice and suffering it entails, they indulge themselves by overeating as soon as they go off it.

Sexy stories and dreary diets

No self-respecting woman's magazine will publish an issue without a "summer," "pre-holiday," "five-day-miracle," "seven-day crash," or "new, fast, easy way to get into your bathing suit" diet. Swept by the general hysteria, even some of the men's magazines have taken to interspersing their sexy stories and steamlined nudes with dreary diets. Disturbingly, any sensationally promoted book about weight reduction is almost sure to reach the non-fiction best-seller list. In most cases, the fiction list would have been a more appropriate place.

Why are diets so popular? Or, to put it more accurately, why have they become such an obsession? The answer is twofold: The twentieth century American concept of beauty —and this applies particularly to the ladies—makes physical attractiveness synonymous with slimness; statistics show that if you are overweight your life expectancy is drastically reduced. The facts on life expectancy are startling.

Example: If you are a twenty year old male, 5 feet 10 inches, of medium frame, you should weigh a maximum of 164 lbs. normally

dressed. If you weigh anywhere between 180 lbs. and 210 lbs, and do not reduce, your estimated age at death is 55.4 years. A person of your age, height and frame whose weight is normal is expected to live to 69.4 years. If you weigh over 210 lbs., your life expectancy is curtailed by an additional two years.

An overwhelming reason

Example: If you are a 25-year old female, 5 feet 2 inches, of small frame, you should weigh a maximum of 118 lbs. dressed. If you weigh more than 130 lbs., your life expectancy is 69.5 years, instead of the normal 75.6 years.

In fact, you don't need statistics to recognize this basic proof. Most octogenarians and nonagenarians look like Grandma Moses and George Bernard Shaw. Winston Churchill is a great exception.

These are powerful motives, but they are obviously not powerful enough to make people diet. Only persons with an overwhelming emotional incentive seem to be able to stick to a diet. An obese girl who falls in love may go on a strict diet, reduce and stay reduced—at least until the wedding day. And a victim of a recent heart attack may be able to muster enough will-power in his struggle for life, and do the same.

But for the vast majority the force of life-long eating habits is much greater than the will-power needed for a prolonged strict diet. Even those who manage to adhere religiously to a specific regimen for 5 (or 15 or 50) days will eventually revert to their old habits and regain their weight plus a few pounds for good measure. That frequently touted stomach shrinkage that takes place during a diet and which is suppose to cut your appetite won't help much either. The all-too-willing stomach will unshrink itself to accommodate the first big meal.

Is it then a hopeless business? Should you, if you belong to the 50 percent of the American adult population which is over-weight, just give up?

The answer is an emphatic no.

Needed—new habits

The fault is not in the dieters but in the diets and the psychology they create. True, obesity is dangerous. It is, in fact, a disease of sorts. But it cannot be cured in a given period of time. There is only one way to combat the weight problem: It is through comparatively small, but significant and permanent changes in eating habits.

At first glimpse, the long-range approach to weight reduction may seem more difficult and trying than the instant salvation offered by crash diets. But as a way of life it is immeasurably easier than the

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Willetta Bar-Illan, nutritionist, food consultant and writer, recently served as special consultant on nutrition to the Israeli government. A former assistant food editor of *Look*, she is now on the staff of *Gourmet Magazine*.

The only way to combat the weight problem is through small but significant and permanent changes in eating habits

torturous on-again, off-again trials of will-power, and certainly healthier than the constant vacillation between semi-starvation and gluttony. What's more, it's the only effective way.

What does it involve?

1) If you are grossly obese, *i.e.*, a woman who weighs more than 200 pounds, or a man weighing more than 250 pounds, don't bother to read the rest of this article. Go see a doctor.

2) If you are more "reasonably" overweight, and if you are interested in improving your chances of living longer and better, you must first find out to what degree you are overweight. This cannot be done on a penny-scale with a superficial chart of average weights. The American Heart Association, the major insurance companies, doctors, and clinics are some of the sources from which you can obtain a detailed, meaningful chart that will show you how much a person of your sex, height, age, body-frame and muscular structure should weigh. However, the proper distribution of weight, which cannot be determined in charts, is also pertinent. If you can count the ribs on your chest, but your belly approximates a state of pregnancy, consulting the chart is superfluous. You are obviously overweight (or pregnant).

3) The charts will also show you what the daily caloric intake which will maintain your weight is, taking into consideration not only your sex, age, height, etc., but also your occupation (sedentary, moderate, or heavy physical activity). This varies enormously with different people. A big-boned farm laborer needs almost three times as many calories to maintain his weight as a petite secretary.

4) In order to reduce, you must consume 500-1000 calories less than you need to maintain your weight. Example: If you are a 35-year-old executive, 5 feet 10 inches, of medium frame and average bone-structure, and your sport activities are minimal, you need about 1800 to 2000 calories to maintain your weight. If you are overweight, you must follow a well-balanced diet which supplies you with approximately 1300 to 1500 calories a day. To be well-balanced, the diet should include 2 servings of meat, fish, shellfish, poultry or eggs (1 gram for each 2 pounds of ideal body weight),

Even if you are a most particular and spoiled gourmet, you can lead a satisfying dietary life. There is no difficulty in finding light, nourishing and calorically low delicacies.

4 servings of fruits and vegetables and 4 pieces of bread or the equivalent in cereals (minimum of 50 grams). The minimum daily requirements of vitamins and minerals should also be included, and a normal American diet, even with 1000 calories shaved off, usually contains these. But if you want to be on the safe side, supplement your reducing diet with a daily multiple vitamin capsule. As soon as you reach your ideal weight, raise your caloric intake to the amount required to maintain this weight according to the charts.

Where to find your diet

Where does one find such diets? Unfortunately they are seldom featured in magazines, newspapers and best-selling fad books. They are available in books and pamphlets by authorities on the subject, and through government health departments (see box opposite.)

5) Although no element of food can be considered completely taboo for a healthy person, fats should not constitute more than 30 percent of the normal person's daily diet, and the less the better. Dr. Lester Morrison, an authority on the subject, maintains there is no proof that any consumption of fat is necessary for growth or for the preservation of good health; and there is very definite proof that fats—particularly animal fats—are at least partially responsible for diseases of the arteries and the heart. Therefore, as a general rule, try to avoid fried foods, fat meats, glandular organs (sweetbreads, brains, kidneys, etc.—but not liver), heavy sauces and dressings, creams and rich pastries.

6) Don't be fooled by the myths about nutrition. You cannot lose any weight by substituting toasted protein bread—with margarine for white-bread-with-butter — caloricall-y, they are practically the same; a regular six-ounce portion of beef is 4 times as "fattening" as a baked

potato; a couple of extra drops of cream in your coffee more than make up for a missing spoonful of sugar; not all fruits are of low caloric value, and some (like avocado and coconut) are not only extremely rich in calories but have a high fat content to boot; an ounce of 100 proof liquor, whether diluted in water or not, contains 100 calories. With ginger ale it provides you with 175 calories.

7) Proper dieting, like good sleeping habits, should become a way of life and not a one-shot project. But just as a night on the town helps alleviate the humdrum routine of regular hours, a culinary binge once a week or so is good for your morale. Especially in the first period of transition to new habits. It will help dispel the feeling that your dining is to be forever spartan.

8) Even if you are a most particular and spoiled gourmet, you can lead a satisfying dietary life. There is no difficulty in finding light, nourishing and calorically low delicacies, and there are numerous good low-calorie cook books on the market for gourmets.

9) *Walk* as much as you can. True, it takes a 35-mile walk to lose 1 pound, but over a period of two weeks this means only 2½ miles a day (including pacing of floors while worrying about your weight). Walk to work if you can, walk to and from lunch, walk around the block, walk in the park. As Dr. Morrison puts it, "We must remember that in the past 50 years there has been a considerable reduction

BOOKS

Reduce and Stay Reduced, by Norman Jolliffe, M.D.; Simon and Schuster ($3.95)

Reduce With the Low Calorie Diet, by Marvin Small; Pocket Books, Inc. (50c)

The Low Fat Way to Health and Longer Life, Lester Morrison, M.D.; Prentice Hall ($4.95)

Food Becomes You, by Ruth M. Leverton; Iowa State University Press, Ames, Iowa ($3.50)

The Safe and Sure Way to Reduce, by Gaynor Maddox; Random House ($3.95)

Foods Without Fads, by Earl Willard McHenry; J. B. Lippincott ($3.50)

Live High on Low Fat, by Sylvia Rosenthal; J. B. Lippincott ($6.75)

Eat Well and Stay Well, by Ancel and Margaret Keys; Doubleday ($4.50)

Gourmet In the Low Calorie Kitchen, by Helen Belinkie; McKay ($4.95)

PAMPHLETS

How To Control Your Weight, Metropolitan Life Insurance Co., 1 Madison Avenue, N.Y. (free)

Food for Family Fitness, The Nutrition Foundation, Inc., 99 Park Avenue, N.Y. 16, N.Y. (free)

Food and Your Weight, Home and Garden Bulletin No. 74, U.S. Dept. of Agriculture, Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. (15c)

Food Hints for Mature People, by Charles Glen King with George Britt, Public Affairs Pamphlet No. 336 (25c)

Personality "Plus" Through Diet—Food-lore for Teen-agers, Charles Glen King with George Britt, Public Affairs Pamphlet No. 299 (25c)
Both available from:
Public Affairs Pamphlets, 22 East 38th Street, N.Y. 16, N.Y.

The Merchants of Menace (free)

The Healthy Way to Weigh Less (free)
Both available from:
Council on Foods & Nutrition
American Medical Assoc.
535 North Dearborn St., Chicago 10, Illinois

in energy expenditure, because of a more mechanized way of life. When it comes to conserving energy, we seem to have approached about as near as we can get to a vegetable existence." Not only is walking an excellent exercise in which your whole body participates but, in congested metropolitan areas, it is sometimes the fastest means of transportation.

10) If you have children, do them a good turn: Don't insist that they "clean their plates," don't commend them for doing so, and for heaven's sake don't use candies and ice cream as rewards for good behavior. By following the same pattern, they may, in adulthood, reward themselves with the very same stuff whenever they feel the need for approval, and thus compulsively rob themselves of a longer life.

11) Finally, to preserve your sanity, promise yourself that whenever you come across a diet that offers a quick and easy solution to your weight problem, you will tear it up and throw it into the nearest waste basket.

★ ★ ★ ★ ★ ★

The dollar value of science

"The discovery that scientific brainpower can be organized to produce useful results with a reasonable probability of commercial success may be one of the really important scientific discoveries of our times." So speaks Arthur C. Merrill, from a background of banking, investment, and science.

The problem of estimating "the reasonable probability of commercial success" of science stocks is Merrill's theme in *Investing in the Scientific Revolution* (Doubleday, New York City, $5.95).

The traditional "blue chips"—such as the oils and the rails—are no longer the investor's best buy. In fact, today's investor will take a beating if he continues to put his faith in them, implies Merrill. He calls for a reappraisal of the tools for judging stocks, less strict attention to the price earnings ratio and more attention to intangibles—depth in top management, emphasis on research, patents held. Such elements, the author holds, may justify an out-of-balance price earnings ratio that would formerly have scared off many a prudent investor. An important stress is given to the basic health of today's stock market.

The problems of today's security analyst are not the problems of the investment advisors of the depression era. The analyst no longer has the problem of working within the framework of an unsound economy. But he must, on the other hand, evolve new criteria with which to evaluate a whole new scientific era, while ever mindful of the lessons of the old economic era.—*C.H.P.*

View from Machu Picchu, lost city of the Incas. These mountains hid the secret city for hundreds of years.

City on a mountain

SOME 400 years ago the mighty Inca Empire was crumbling beneath the weight of the Spanish conquest.

High in the Peruvian Andes the Incas built a city in which they could hide themselves from the conquistadores. Inca civilization was destroyed, but the mountain city was never found by the Spanish, al-

Hidden amid higher peaks Machu Picchu itself was built at an altitude of 8,000 feet. Throughout their history the Incas were a mountain people, and today their descendants can live at altitudes that are uninhabitable for others.

A Quecha woman walks down the steps from the ruins of Machu Picchu.

This fortified tower was one of the defenses the Incas built for the city.

A Quechua Indian, one of the descendants of the Incas stands next to an intricately constructed wall in Machu Picchu.

though tales of a "lost" Inca city circulated for centuries.

In 1911 Professor Hiram Bingham of Yale discovered the city while climbing in the Andes. He named it Machu Picchu for the region in which it is located.

Since Machu Picchu was never looted, it has been a vital source of our knowledge of the Inca Empire.

Curiously the bones found among the ruins seemed to be chiefly those of young women and old men, and scholars speculate that the city was primarily a hideaway for virgins of the sun and priests.

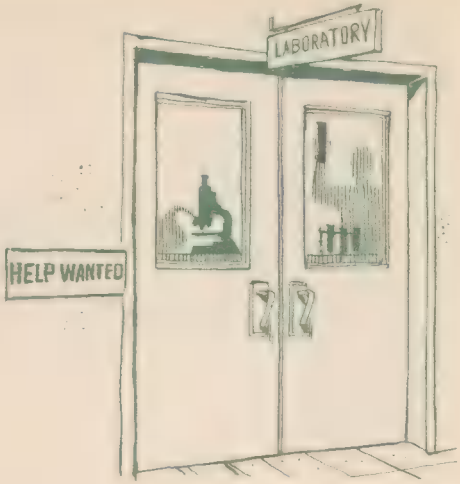
Machu Picchu is located 75 miles from Cuzco, old capital of the Inca Empire, which at its height included Peru, Ecuador and parts of Argentina and Chile.

Today Machu Picchu is being restored under the direction of engineer Eulogio Cabada Hildenbrandt. The city's remarkable architecture and spectacular setting make it a magnet for archaeologists and tourists alike.

It is a striking and melancholy monument to the greatest empire of ancient South America.

Eulogio Cabada Hildenbrandt, engineer in charge of restoration (left) and a workman examine diagram of a wall. Numbers on the stones indicate their proper position.

Is science on the skids?



SCIENCE today is mushrooming, that's true. But we seem to think this growth is something new, and that just isn't so.

For the last two and half centuries, science has doubled in size every ten to fifteen years. The result is that, at any given time, seven scientists are alive out of every eight there have ever been. During the active career of any scientist, he witnesses 80 to 90 percent of all scientific work that has ever been done. This stimulates the feeling that science has made a sudden surge.

In a new book, *Little Science, Big Science* (Columbia University Press, New York City. 119 pp. $4.50), Yale science historian Derek J. de Solla Price documents these trends and projects the future of science.

By approaching the limits of qualified manpower, Prof. Price believes, the accelerating growth of U. S. science has already been slowed. In thirty years, the rate of growth should actually drop. Depending on how it adapts, U.S. science eventually will stop growing, fluctuate wildly or gather itself for another sustained climb.

What we lack in manpower, we are trying to make up with money. Since World War II, we have doubled our spending per scientist every ten years, pushing what Prof. Price calls "little science" out of the dusty laboratory into the "big science" world of multimillion-dollar atom smashers.

Whatever we do, one thing is sure: Soon the presently underdeveloped countries will start on the same spectacular science spree we have been on. We may remain one of the leaders, but our relative share of world science will shrink.

—*B.H.F.*

the progress of MEDICINE

by Arthur J. Snider

How does your seat rate?

THE seat of the boss's bad back may be in his chair. Efforts to make it more impressive and luxurious looking usually lead to giving it an excessively long sitting section (19 inches) and a nearly right-angled back with no lumbar support, says Dr. J. Jay Keegan of the University of Nebraska. In addition, soft cushioning and long arm rests make the chair restrictive when a change of position is necessary.

The stenographer's chair is much closer to a correct one, Dr. Keegan points out. It has a small back support, no shoulder support, short seat length (14 inches) and adjustable height.

Dr. Keegan, who has long studied problems of chairs and sitting, says improvement in design has long been handicapped by a lack of knowledge of physiological and medical factors. There is still the widely-held misconception that shoulder support is more important than back support and that people should sit at a right angle.

Dr. Keegan gives this rating on the seat situation in *Industrial Medicine and Surgery*:

Occasional chairs: Their common fault is no lumbar support, too long a seat and excessive height for a short person's legs.

Lounge chairs: They violate most rules of correct seating except the angle of the back. They're too large, too long, boxed in front and often so low that rising from them is impossible without sliding forward and without hand assistance.

The excessive cushioning is comfortable at first but the twisting, bending force necessary to arise may rupture an already-degenerated lower lumbar disc.

Stadium seats: Because of space requirements, the grandstand seat

has a correct length and height of 16 inches with an open front. The angle of the back is somewhat small. The bleacher seat has no back support and is thus inferior to the grandstand seat. But it can be improved markedly by attaching a metal frame with cushion and narrow canvas back.

Auditorium seats: The 95-degree angle of back with no verticle curve makes long sitting difficult. Full-length arm rests in these crowded seats put uncomfortable pressure on the elbow.

School seats: In spite of all the special study devoted to the problem, children vary so much in size and are so restless, standards are hard to establish.

Church seats: From time immemorial, church pews have been designed in the worst possible manner for comfort. In recent years, seat cushions have been added, but the person with low-back trouble still finds them impossible. Standing to sing and kneeling to pray give some relief.

Rail station seats: Few features to recommend them for comfort.

Where medicine stands on cataracts and glaucoma

Cataracts need no longer be feared by the elderly as they once were. Dr. Malcolm McCannel, University of Minnesota ophthalmologist, says cataract surgery today has a very high success rate.

Glaucoma, however, is another matter. It afflicts about two percent of all people over 40. Glaucoma has very few symptoms. The central field remains quite sharp while the peripheral field is deteriorating. The patient remains unaware of his condition because of the good central vision.

When the disease is diagnosed, new drugs can often control it, but the damaged areas cannot be restored, Dr. McCannel says.

What's ahead for your heart

What's ahead for your heart in the next 10 years? A symposium sponsored by the New York Heart Association brought these predictions:

Dr. C. Walton Lillehei, University of Minnesota surgeon: "I look forward to the use of a completely mechanical heart inside the body."

Dr. Helen B. Taussig, Johns Hopkins University pediatrician: "I believe the most significant developments will come in the understanding of the cause and thereby of the prevention of congenital heart malformations."

Dr. Frank Glenn, surgeon, New York Hospital-Cornell Medical Center: "I foresee wide acceptance of regulation of diet according to body needs" as the basis for preventing

arteriosclerosis, the most frequent cause of fatal heart disease.

Dr. Michael E. De Bakey, Baylor University surgeon: "There will surely be developments along the lines of replacement of heart valves and transplantation of various organs, with perhaps successful transplantation or substitution of the heart itself."

Injection to help kick the smoking habit

A tobacco withdrawal clinic is intended to fill the gap between the doctor's order, "You have to stop smoking," and the patient's answer, "Yes, I would like to, but how?"

There are several such clinics in Stockholm, reports Dr. Borje Ejrup of the Karolinska Institute. Treatment consists first of educating the patient about his smoking habit. He then is given "nicotine saturation" by injection to provide a substitute for nicotine and rid the patient of his craving. The desired saturation point is reached when a slight feeling of nausea occurs on attempting to smoke, usually after about 10 days. The method, says Dr. Ejrup, is comparable to Antabuse in alcoholism.

In a very few cases, where the saturation method fails, silver salts in a liquid gargle are used. This will produce a foul taste when smoking is attempted. However, discoloring of the teeth is an unfavorable side effect.

Patients say that coughing disappears, work capacity increases and food tastes better after they quit smoking.

Results to date show that about 75 percent stop smoking entirely and 21 percent decrease their cigarette consumption to one-fourth or less.

How good are contact lenses? What do wearers say?

Do patients wear their contact lenses? Does the wearing of contact lenses result in damage to the cornea?

Dr. Alfred A. Wick of the University of Michigan Medical Center interviewed and examined 100 contact lens wearers at the Medical Center's department of ophthalmic surgery.

He found that 14 of 39 who wore scleral lenses had discontinued their use as compared with only four of the 61 who wore corneal lenses. Scleral lenses are those that fit over the tough white covering of the eyeball, while corneal lenses cover just the cornea itself.

Twenty-seven corneal lens patients wore their lenses over eight hours a day as compared with three in the scleral lens group.

Seventy-five percent of the corneal lens patients were satisfied

with their lenses, compared with 58.9 percent of the scleral group.

About half the patients in each group said they could function as well with their contact lenses as with spectacles. The principal complaints were irritation and tearing. Sensitivity to bright sunlight made wearing sunglasses necessary for some.

Contact lenses improved visual performance for many, permitting them to do things they could not do with spectacles.

Do the lenses fall out?

Not according to wearers of the scleral variety, but 16 of the corneal lens group found that the lenses could be dislodged spontaneously or as a result of rubbing the eyes or blinking.

Women got the lenses chiefly for vanity and cosmetic purposes, Dr. Wick reported in an article published in the *Journal of the Indiana State Medical Association.* Men, on the other hand, got lenses for medical and occupational purposes, such as athletics. The majority of both sexes were nearsighted.

Irrespective of the reason for getting the lenses, the majority of wearers in each group were satisfied.

Corneal staining, an injury to the cornea, occurred twice as frequently in the corneal lens group as in the scleral group. In no case, however, was there any permanent damage to the eye. The damage usually cleared up within 24 hours after the person stopped wearing the lenses.

Because of the possibility of the corneal lenses' becoming dislodged from the eyes, Dr. Wick believes the scleral lenses are best for athletic purposes. However, he points out that the corneal lens is best for cosmetic purposes.

Danger signal: white patches in the mouth

Don't disregard a white thickening of tissue within the mouth. It's called leukoplakia and is quite harmful in itself. And it can lead to a malignant growth within the mouth, says Dr. J. Ernest Breed of Northwestern University medical school.

Dr. Breed says about two to three percent of all people over 50 years of age have leukoplakia. It is frequently associated with the use of tobacco, although sometimes dental disease can cause it.

The cheek is most often involved, followed by the tongue, lip, gum, palate and floor of the mouth. It can appear in several sites.

Preventive treatment consists of removing sources of chronic irritation, discontinuing use of tobacco and including adequate vitamins in the diet.

KFS

Mark Twain science writer

EVERYONE knows that Jules Verne had an uncanny knack of figuring out what the inventors were going to be up to decades later. But Mark Twain, it appears, was a pretty good guesser, too. Almost 65 years ago, he called the turn on video's latest—global TV.

In the November, 1898, *Century Magazine,* Twain had a "telelectroscope" saving the life of a condemned man as the sheriff was about to spring the trap.

A young Austrian named Szczepanik had invented a device by which "the daily doings of the globe [were] made visible to everybody and audibly discussable, too. . . ." Apparently it worked on a subscription basis. One plugged in to an "international telephone station" and was put through to any part of the world one wanted to see or hear.

Unfortunately, the young inventor got into a series of quarrels with Lt. Clayton, a U.S. Army officer who scoffed at his gadget. After a couple of encounters, the last one in Chicago, Szczepanik suddenly dropped out of sight. Then a body identified as Szczepanik's turned up in Clayton's cellar and the latter was convicted of murder.

It was four a.m. and the condemned man was waiting for the hangman. Suddenly he felt a wish to see the sun once more before he died, and he tuned in China. He was watching the Chinese Emperor's coronation when the sheriff arrived and led him to the scaffold. A friend, a last-minute visitor to the cell, cast a parting glance at the telelectroscope and suddenly shrieked in amazement and delight. In the crowd 12,000 miles away watching the coronation, stood the supposedly dead Szczepanik!

Justice triumphs!

Clayton was reprieved. But the satiric Twain could not resist a slam at judicial systems. He had the unfortunate officer hanged on the ground that once the court has spoken it cannot reverse itself. Twain was aiming at the French court that had done some weird things in the Dreyfus case.

However, dead or alive, Clayton was one of global TV's earliest fans.

—Ralph Bass

World's Fair Dinosaurs

Eons ago a hothouse climate bred 7- to 70-foot lizards. They'll make a comeback in New York next year.

Bony armor down his back made Ankylosaurus too tough a mouthful even for Tyrannosaurus. And he had a rib-cracking tail he could swing like Mickey Mantle. The tail was purely defensive, however, for this plodding tank was vegetarian. This full size clay statue will serve as a pattern for the final fiber glass model.

His long neck was like a submarine snorkel, so when he sensed danger, Brontosaurus headed for deep water. The "thunder lizard," so-named because the ground shook when he walked, weighed 40,000 pounds, all of it dumb. His brain was only half the size of a human's. One scientist says, "He was about as stupid as an animal could be and still live." At the World's Fair this fiber glass Brontosaurus will be able to flex his astonishingly long neck.

In his hey-day the 50-foot long Tyrannosaurus Rex was ■ vicious "king of tyrants," the most terrible animal that ever lived. He could eat half a 30-foot duck-billed Trachodon in one meal. This model won't eat anything but will have a moving jaw to bare its six-inch teeth.

NINE dinosaurs, the "terrible lizards" that once ruled a swamp-and-jungle world, will reign once more. However the size of their domain will be reduced to a corner of the 1964-65 New York World's Fair, beginning next April 22.

Sculpture Louis Paul Jonas is recreating them life-size for the Sinclair Oil Corp. exhibit.

Dinosaurs perished some 63 million years ago. With their small brains and ravenous appetites they couldn't adjust to hard times as the climate turned colder. Since man evolved much later, visitors to the fair will be able to see creatures even their earliest ancestors never knew.

What's behind the Moscow A-talks

Preview of tomorrow's nuclear terror

by William J. Perkinson

THERE are three excellent reasons why leaders of the United States, Britain and Russia have sought to end indiscriminate testing of atomic weapons and other nuclear devices.

The reasons encompass new concepts that basically involve:

1. The building of so-called gigaton weapons.

2. Placing nuclear weapons in orbit about the earth.

3. The creation of "radiative weapons in or from outer space."

Gigaton, a contraction of the words gigantic and tons, is a new term being used to describe the power of the proposed new atomic weapons. (It is pronounced jy-gaton.)

Such weapons would be as different from the most powerful of today's hydrogen bombs as the H-bombs themselves are from the most powerful of conventional high-explosive bombs of World War II.

The smallest of the gigaton weapons as presently conceived would have the explosive equivalent of a billion tons of T.N.T. That would mean that they would be ten times more powerful than the 100-megaton monster that Russia is already thought to have in its arsenal. Premier Khrushchev has implied that Russia cannot test its biggest H-bomb at either the Soviets' Arctic or at its Central Asian proving grounds because the 100-megaton test might cause severe damage to Russia itself. The only way it currently could be tested "safely" seems to be in outer space. Its estimated bulk and weight make that "unlikely."

Yet even bigger and better weapons are already being planned by atomic weaponeers.

Dr. Albert Szent-Gyorgyi, Nobel Prize winner, in an open letter last fall wrote:

"The 1,000-megaton bomb (1,-

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- Gigaton H-bombs big enough to burn up six states or inundate the East Coast
- Constantly orbiting nuclear satellites ready to plummet earthward in a second
- Gigantic explosions in outer space to disrupt the world's weather

000,000,000 tons) is clearly in sight, capable of wiping out six of our states in one bang or destroying the whole East Coast with one tidal wave."

Nearly a year earlier the Atomic Energy Commission in a formal report stated that "studies" show:

"A 100-megaton burst at about 4,000 feet in the ocean would generate wave heights 28 to 70 feet at a range of 100 miles and 3 to 7 foot waves at 1,000 miles." The AEC report added that waves at shorelines closer to the point of the blast would be much higher.

Nearly three years ago, an article in the Air University *Quarterly Review* discussed the possibility of using submarines, or surface ships to transport "gigaton weapons of several hundred megaton power" and of the possibility of placing such devices in orbiting satellites.

The significant point about all three references is that in 1960 and 1961 atomic weaponeers were thinking of ways to use gigaton weapons of "several hundred" megaton power, while today they are thinking of ways to use gigaton weapons of "several thousands" of megaton power.

Some of the ways involve use of gigaton weapons as conventional bombs in orbit, as remote controlled mines inside sunken ships off an enemy's coast, or in a fantastic manner in outer space.

At the moment the threat of using orbiting H-bombs as a potent military weapon does not seem quite real from a military viewpoint.

The facts of orbital weapons currently are these:

Russia is thought to have the capability—because of its large boosters—of placing H-bombs of perhaps up to 10 megatons power in low earth orbit 100 to 500 miles up. The United States, however, has demonstrated it has the hardware to shoot down such bomb-carrying satellites.

With the neutron bomb, radioactive rays would kill all life within an area without destroying or permanently contaminating material things

But the fear that Russia may put an H-bomb in orbit is still a very real fear. During the Cuban crisis, last fall, for instance, the first thing that experts wanted to know about each Cosmos class satellite the Soviets launched was, "What is its weight?"

The unspoken question was: Would Khrushchev reply to President Kennedy's demands by proclaiming that Russia not only has atomic weapons in Cuba but also has hydrogen bombs orbiting above the United States?

The fantastic rate of growth in atomic weapon technology can be illustrated quite easily and simply.

The first United States hydrogen device which literally ripped the island of Eluelab from the floor of the Pacific, was rated at about three megatons. It was called a device rather than a bomb because it weighed some 65 tons.

Today a Martin-built Titan rocket can loft a 10-megaton hydrogen bomb type warhead halfway around the world. The Titan warhead, according to its type, is unofficially estimated to weigh only between 1 and 3 tons, yet its explosive power is three times that of the first H-bomb.

The greater efficiency of the Titan warhead, of course, is due to the rapid advances made in miniaturization of atomic weapons as a result of lessons learned from testing.

Some experts argue that Khrushchev would not place an H-bomb in orbit because in addition to being ineffective from a military view, an orbiting H-bomb would alienate the opinion of neutral nations. An H-bomb in polar orbit would float across every nation in the world, including Russia, several times a day.

Other experts say that if Khrushchev did order an H-bomb in orbit, the United States could reply by using Syncom-like satellites to suspend smaller H-bombs, like a space-age sword of Damocles, over Moscow itself. Syncom satellites are designed to orbit at such a high altitude that they appear to be hovering over a given area of the earth.

All experts agree that the greatest arguments against putting H-bombs in orbit at the moment are: that such weapons are less accurate than the more powerful ground based ICBM's and, that it would be necessary to launch a fleet of H-bomb carrying satellites to even partially paralyze nations as large as the United States or Russia and that, the time it would take to launch such a fleet of satellites

would alert either the United States or the Soviets to the other's intentions of "committing a grave 'warlike' act."

A more subtle way of achieving the destruction of the United States or weakening its will to resist would be to use the gigaton weapons in sophisticated orbits in outer space, distances as far away from the earth as the moon.

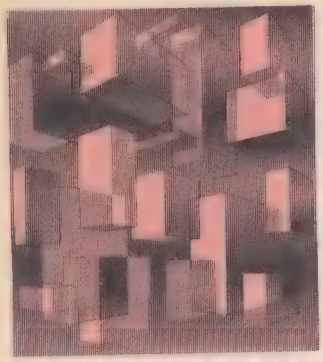
Some of the concepts of using the super-super H-bombs in outer space involve the concept of a neutron bomb in which certain radioactive rays would kill all biological beings in an area without destroying or permanently contaminating material things in that area.

Other concepts involve the explosion of two or more gigaton devices on collision courses more than 500,000 miles above the earth to create magnetic storms that would vastly affect the weather on earth.

One theory is that when a nation learns just what adverse effects its tests have on the world's weather it could weaken the other nations' wills to resist by stockpiling in advance the materials it would need to carry it through a prolonged spell of severe weather and then use its super bombs to suddenly modify the world's climate.

The theory is that few nations would be able to stand firm in the face of such threats, particularly if the threats were provable.

Despite the awesome power of one nation to overkill another with weapons currently in the various arsenals, the outlook of what may come—and come quickly—indicates that the limits of nuclear terror have not been reached yet.



INVENTIONS PATENTS PROCESSES

Inventor of

With this issue, Science Digest begins a regular feature honoring the inventor whose discoveries are judged to be of the greatest current interest.

William Watson, who has discovered a new way to raise sunken vessels, is a resident of Marblehead, Mass., noted New England yachting center.

TO A Massachusetts engineer goes the first citation as Science Digest Inventor of the Month. He is William Watson, who has proposed a way to raise sunken vessels by filling them with strong plastic bubbles. The bubbles are designed to expel the water and provide enough buoyancy to lift the ship.

The inventor lives in Marblehead and manufactures plastic products in his plant at Salem. He is asking the Coast Guard for the site of a sunken yacht and hopes to try out his system this summer.

Patent 3,091,205, which was granted to Watson recently, explains that the bubbles are formed in the submerged hull by mixing a resin and

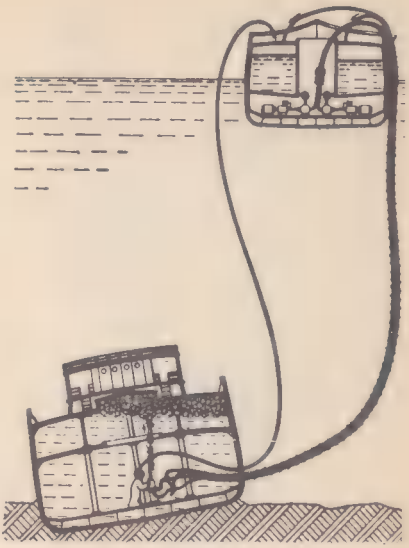
Pop goes the weevil

The Department of Agriculture plans a new attack on boll-weevils this summer. An experimental machine that picks up and destroys weevil-infested cotton squares will be tested in Louisiana cotton fields. These fields will then be compared with cotton plots that have been treated with the usual insecticides to determine the success of the machine.

The machine is equipped with flails rotating about 1,800 times a minute giving it a vacuum cleaner-like suction and enabling it to lift weevil-infested cotton squares from the ground where they have fallen. The flails beat the squares to a pulp, killing the weevils, and blowing the remains back on the ground.

Mature boll weevils lay their eggs in growing cotton squares. Hatching larvae feed on the squares and the squares fall from the plant. If the squares are not destroyed, the larvae develop into weevils.

Eddie C. Burt, agricultural engi-



a catalyst. The two substances are pumped down in separate hoses from a salvage vessel and passed through a mixing nozzle.

This system could not be used to raise the sunken nuclear submarine *Thresher*, which lies 8,400 feet deep, about 220 miles east of Boston. The system requires the use of a diver, and experts explain that divers cannot go more than a few hundred feet deep.

The Patent Office examiners were skeptical that the bubbles would form under such hydrostatic pressure. Watson submitted the results of experiments that showed that a buoyant foam could be produced under pressures equivalent to those at 90 feet or more below the surface.

A diver can place the hoses in compartments of the submerged vessel, and he can release the valves. The compartments need not be watertight, according to the patent, but any open hatches or companionways will have to be covered.

Watson, who had long worked on foamed plastics for industry, conceived the idea after the *Andrea Doria* sank. She is now too deep in mud to be raised, he says, but there are many more-recent wrecks on which to work.

The foam used has closed rather than interconnected cells. It can be created, the patent says, from one of several liquid resinous materials on the market, in the presence of a catalyst, one of the amines or peroxides.

The inventor, who is president of Techcraft, Inc., has a large foaming machine at the company plant in Salem. He plans to use this in experimental operations, but smaller equipment would be adequate for salvage work.

After a vessel is raised and towed to dry-dock, the foam can be cut out in chunks with shovels or other sharp tools. Watson describes it as having the consistency of soft plaster.

—Stacey V. Jones

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neer of the Department of Agriculture's Agricultural Research Service and designer of the machine, expects his machine to pick up 95 percent of the fallen squares. Entomologists have found that even picking up 90 percent of the fallen squares by hand every five days is enough to insure a good cotton crop without the use of insecticides.

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"Where's the midget?" asked one pedestrian, as he gave "Lively Louie" the onceover.

"Who's that in there who said that?"

New York's Times Square has long lost its ability to startle jaded New Yorkers—or has it? One day not so long ago, a trash can talked back to a careless pedestrian who threw a gum wrapper on the sidewalk.

"Madame!" said the trash can, "A cleaner New York is up to you!" A crowd gathered around the trash can. "Is there a midget inside?" someone asked.

The voice did not come from a midget, but from a full-sized Department of Sanitation worker using a two-way microphone from an office a couple of stories above. A small microphone was concealed inside the trash can. The talking receptable, known as "Lively Louie," is just one of many gimmicks now being used in New York by the Department of Sanitation to promote cleanliness.

Do-it-yourself spying

An attache case that conceals a microphone and will record sound from as far as 25 feet away for as long as two hours, is offered by American Geloso Electronics, Inc., 251 Park Avenue South, New York 10, N.Y. The case has a concealed microphone and switch. A soundproof compartment houses its miniature, battery-operated recorder.

Maternity quarters for expectant sows

Isolation quarters in which an individual sow can give birth to, and

raise, her young, have been designed by the Nutrena feed division of Cargill, Inc., Elk River, Minn.

"Isolit," as the system is called, is intended to reduce the death rate, due to disease, of young pigs. Such disease losses, which can range from ten percent to an entire litter, can be reduced to almost zero, the company's research shows.

Separate units are placed at least eight feet apart to eliminate the danger of air-carried bacteria. Pig-to-pig contact is also minimized by the separate units, further reducing the chance of diseases' spreading. Usually, it is not necessary for even the farmer to enter the unit. Sows themselves are thought to prefer individual nesting.

The unit has nine inch high heavy oak and metal guard rails separating the baby pig area from the sow's, allowing the young pigs easy access to the exercise pen and to the sow for nursing. Accidental deaths due to crushing in Isolits are said to run less than one percent, compared to the national average of 14 per cent.

A Cargill-Nutrena swine specialist demonstrates how a farmer can reach a pig through a roof door of an Isolit farrowing unit, without having to enter it.

Next—convertible aircraft

Twenty tons of cargo, or 50 passengers—Republic Aviation's convertible transport plane could carry either and it could carry them straight up, according to the Farmingdale, N.Y., aircraft company. The 29-foot cargo pod suspended beneath the "Flying Crane," as the proposed plane is called, would make this carrying feat possible.

The plane could take off and land

Vertical-take-off-and-landing aircraft capable of carrying either 20 tons of cargo or 50 passengers in a pod suspended beneath the craft. Model was exhibited by Republic Aviation at the National Flight Forum.

vertically, thanks to a 90-degree rotation of the nozzles of its two main engines, augmented by lift engines in each wing tip. Such a plane could travel 500 miles and would have a speed of approximately 400 mph.

The "Flying Crane" was one of four advanced forms of transportation displayed in model form by Republic Aviation at the Second National Flight Forum Symposium. Also on display were: a supersonic jet fighter-bomber capable of taking off vertically, then switching to forward flight; a commercial airliner that could make the New York-to-Paris flight in 2½ hours at cruising speeds of 2,000 mph.; and a rubber-tired monorail transit car able to travel faster than today's trains.

The human touch for fish

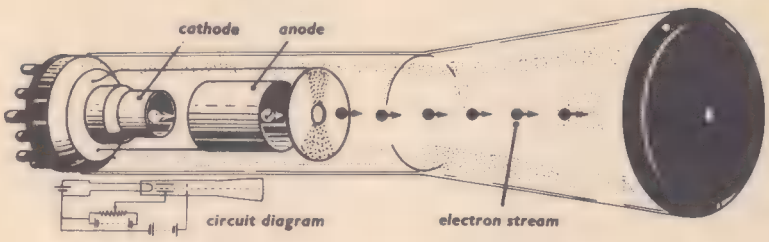
The Eureka aquarium purifier will keep a fish tank in clean and healthy condition without the use of a filter box, according to its manufacturer, Eastman Chemical Products, Inc., 260 Madison Ave., New York 16, N.Y. It employs the aquarium gravel as a permanent filtering medium, using the same principles of aeration used to prepare water for human consumption. The purifier itself is made from transparent plastic tubing. To install the system, the base is buried in the gravel, the air tube is connected to the air pump, and the water tube is cut off just above the water level with a handsaw or sharp knife.

New water-purifying system for fish tanks uses aquarium gravel as filtering agent.

Pocket sized three meals

An emergency food kit for outdoorsmen, the "over-nighter," will fit in a sportshirt pocket, is waterproof, and is guaranteed for two years by its manufacturer, Chuck Wagon Foods, Newton 64, Mass. The kit, which weighs less than 8 ounces, contains a compressed cereal bar, a starch jelly bar, tropical chocolate bars (all government approved foods), toilet paper, single-edge razor blade, Band-aids, monofilament fishing line, fish hooks, salt packets, wax-dipped wooden matches, a large sheet of extra heavy aluminum foil which can be shaped into a cooking pot, and a Survival Instruction Booklet.

YOUR SCIENCE ABC's



A stream of electrons produces the picture on a television or cathode-ray tube.

Now anyone can understand

ELECTRONICS

An electric current is a stream of electrons flowing along a metal wire or conductor. If the two wires from an electric supply are separated by an air gap no current can flow across from one wire to the other. However, the two wires may be sealed into a glass tube and the air pumped out.

As soon as most of the air is gone, the electrons begin to pass across from the negative wire to the positive wire. They can do this even if the gap is quite wide, and when they are thus traveling freely through an empty space they show properties that are not found in an electric current flowing along a wire.

Electronics is the study of these properties and their utilization for the service of man.

Most electronic devices are therefore enclosed in glass tubes from which the air has been pumped out, or which contain the merest traces of gases. The wires that enter the

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tube are called "electrodes," the negative one being the "cathode" and the positive one the "anode." The electrons always travel from the cathode to the anode. They cause the trace of air or gas left in the tube to glow with a cold light.

How X-rays are produced

The stream of electrons sent out from the cathode are called "cathode-rays." If they are very powerful, they cause the anode to emit rays of its own when they strike it. These are X-rays, which are like light rays, but of much shorter wave length and invisible. They are able to pass through many solid substances which are opaque to light rays, such as cardboard, wood and animal flesh. They pass less easily through bone, and so can be used to photograph the bones inside a living body.

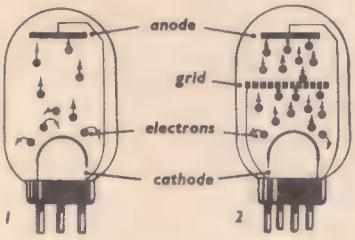
The most widely used electronic device is the "electron tube." This is a kind of valve or regulator that can control the flow of electrons. A current passing through a tube may be changed in various ways by the action of the tube. It may be caused to flow in surges instead of steadily, it may have electronic impulses or "signals" inserted in it, or if it already contains weak signals these may be enormously amplified. Most important, a tube acts as a "one-way street" for electricity, allowing it to pass through in one direction only.

There are two common types of electric current. In a "direct" current (DC) the electrons flow steadily from the negative to the positive. In an "alternating" current (AC) they do not flow along at all; they merely vibrate a short distance backwards and forwards, each end of the wire becoming first negative and then positive in rapid alternations. The signal received by a radio aerial is a current of this kind. There is no supply of electrons to flow through the wire, but the electrons already in the atoms of the metal are shaken backwards and forwards.

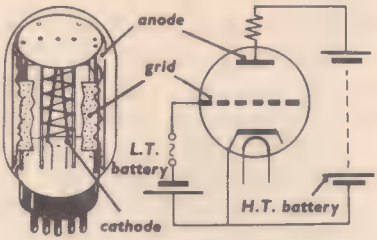
This slight oscillation of electrons in the aerial is useless for working a radio set, which requires a current flowing in one direction only. The conversion of the oscillations into a direct current is done by means of a tube called a "rectifier." This contains a cathode and an anode, as in the tubes already described, only the cathode is of a peculiar kind. It is in the form of a little cylinder, which is heated by means of an electric filament inside it.

Changing the current

Now, hot metals throw off electrons on their own account, so that the "hot cathode," as it is called, is always charged with negative electricity. When an alternating current is fed to the cathode, every time the electrons in the current move forward they escape from the cathode because the positive anode attracts them across, and so they pass through the tube. But when the alternating current changes its



1. Diagram of a simple electron tube.
2. The same tube fitted with a grid.



A more complex type of tube called a triode and a diagram of how such a tube would fit into an electrical circuit.

direction the electrons cannot pass back again because the electrons produced by the hot cathode repel them. Thus this tube serves to convert the oscillating current generated by radio waves in the antenna into the direct current needed to work the radio.

The type of tube that can magnify weak signals is called an "amplifier." It is constructed in the same way as a rectifier, but a small piece of wire netting or perforated metal is inserted in the space between the cathode and the anode. This is called the "grid," and it is connected to the electric supply carrying the weak alternating signals. These come in the form of little groups of electrons, and they interfere with the electrons passing through the grid from the cathode to the anode. Thus, the signals on the grid are represented by variations in the current flowing through the tube; the variations are much stronger than the weak signals that cause them.

Quite a different sort of electronic device is the cathode-ray tube, which produces a strong, narrow beam of cathode rays. This tube is quite large—rather like a giant pear. The cathode is situated right down in the "stalk," and the anode is a little way in front of it. But the anode has a hole in its center, and when the electrons shoot across from the cathode to the anode most of them pass right through the hole and travel in a straight line till they hit the glass at the other end of the tube. The point where they hit is made visible by coating the inside of the glass with a substance that shines brightly when struck by electrons.

Making a TV picture

A beam of electrons can be bent by passing it between a magnet's poles. A television picture tube is a cathode-ray tube in which a beam of electrons is controlled by two electromagnets set at right-angles to each other. One causes the beam to swing across the tube so as to draw horizontal lines across the screen, and the other draws it down so that

With transistors an entire radio receiver can be made smaller than a lump of sugar.

the lines come under one another and cover the screen from top to bottom.

When a very small electronic device is required, the bulky tubes are replaced by "transistors." These make use of "semi-conductors," such as the elements germanium, silicon and selenium. Crystals of these substances can be arranged so that electricity can pass through them in one direction but not in the other. Electrons can move through a semi-conductor but only with difficulty, and when a metal point is brought into contact with a crystal backed by a metal plate, electrons will flow from the point through the crystal to the plate, but not from the plate to the point. A transistor the size of a match-head can thus perform the duties of a rectifying tube the size of a pigeon's egg. A transistor will work on less than a millionth of the power required for a tube.

How to save a dying sea

GOURMETS are getting nervous stomachs over the possible drying up of the supply of sturgeon black caviar. In the last 25 years the level of the Caspian Sea, where the Soviets get 95 percent of the world output, has dropped over eight feet. The drop also threatens chemical, paper and other industries.

Scientists blame irrigation, hydroelectric projects and a decrease in snowfall over the basin of the Volga River, which feeds the Caspian. The result is that evaporation and other losses now outstrip inflow.

The New Scientist reports several huge-scale remedies being considered by the Soviets. One scheme is to divert the Ob and Yenisey Rivers hundreds of miles across Central Asia to the Aral Sea and on to the Caspian. Both rivers empty into the Arctic Ocean.

A less ambitious plan is to connect to the Volga two smaller rivers, the Pechora and Vychegda, which also flow north. Still another idea is to dig a canal from the Caspian to the higher Black Sea over 300 miles to the west.

Egged on by the sinking waters, scientists propose longer and longer canals, but something will have to be done eventually if the sea is to be saved.

Beware of summer glare

by August Nelson

**Strong light—natural or artificial—
is not only dangerous to your eyes,
it can influence your personality.
Here are some practical ways to protect yourself.**

THE naked light bulb has long seemed a cliché of grade-B movies.

Every gangster movie of the '30s had, as a standard scene, a suspect getting the third degree under glaring lights. Later Nazis, then Communists in turn, were shown grilling prisoners with the same classic bright-light equipment.

Scientists tell us, however, that hard facts lie behind these fiction presentations. Glaring lights, they say, can induce tremendous discomfort and fatigue. Over long periods of time, glare can cause extreme agitation, confusion and even personality disorientation.

One expert on vision has speculated on the notorious "temperament" of some television stars. Exposure for long periods of time

Glaring lights can cause extreme agitation, confusion and even personality disorientation. However there are effective ways of warding off these effects.

under glaring Kleig lights, according to this specialist, may be the cause of their on-edge emotional states.

In addition to the psychological, there are also some physiological effects of glare.

Glare exists in many degrees. All of us have experienced the discomfort produced by glaring light as we work or read. In milder forms, it may cause visual fatigue, heaviness of the eyes, squinting and the like. But extreme forms of glare may be very dangerous. Staring directly into the sun can result in permanent damage to the eye, the burning of the retina. An occupational hazard of arc welders, "welders' flash"—an extremely painful condition of the eyes—is also caused by extreme glare.

While most of us do not encounter such extreme exposures to glare, there are situations in everyday life in which excessively bright light should be guarded against.

Our body has a number of built-in safeguards to help us—particularly to protect the retina, the innermost layer of the eye. This is the sensitive portion of the eye which receives the image formed by the lens and transmits it (via the optic nerve) to the brain to tell us what we're seeing.

Have you ever wondered about the color of people's eyes? One of nature's ways of shielding the retina from light is the pigment of your eyes. Light-complexioned people with light gray or blue eyes are more sensitive to light, because their eyes are less well shielded.

Have you ever experienced a sensation of pain as you've come from a dark theater suddenly into bright light? This is perfectly normal, another example of built-in light-control. The pupil suddenly contracts in the sun's glare and the discomfort represents only the suddenness of the pupil reaction.

In spite of defenses, however, excessive light and glare can reach the retina and can cause changes in its complex structure.

Bleaching the eyes

The retina is made up of two types of sensory bodies—the rods and the cones. Each contains its own pigment, which serves separate and distinct functions, and which may be affected by excessive light.

The cones of the retina contain a photo pigment which is the material responsible for the eye's ability to appreciate color. If you experience a great deal of glare, this pigment, in a chemical process, is bleached and your eyes' ability to sense color is decreased.

It is a common experience, after being in the glaring sun at the beach or on the ski slopes, to have this temporary loss of color discrimination—where everything looks black and white for a few moments.

After a bit of time out of the glare, the pigment normally is regenerated. Some people, however, due to vitamin A deficiencies or

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August Nelson is executive secretary of the Better Vision Institute.

Low-quality sunglasses may filter out some light but may not adequately shield the eyes against rays that are harmful

illness, have trouble with the regenerating process. These people temporarily live in a world of black and white only.

There are other physical discomforts you may experience from overexposure to glare: headache, nausea, red-rimmed and irritated eyes and the like. At the beach and under other glare conditions, this is guarded against simply by wearing high-quality sunglasses.

Not all tinted lenses are effective in protecting the eyes. The proper high-quality lens selectively filters out those rays of the sun which have a harmful effect on your vision. Low-quality lenses may filter out a certain quantity of light but may not adequately shield against the harmful rays. Eye-care specialists warn against a casual attitude of parents toward proper sunglasses for children. Often children's sunglasses are treated as if they were toys. Lenses that are not optically ground or are otherwise inferior may be uncomfortable. In addition to their failure to protect the child's eyes, they may have distortions. These place an extra burden on the child's vision and at the very least may cause discomfort and strain.

Glare, particularly at night, has its life-or-death aspects, too. Glare may gravely affect your ability to see objects clearly at night, and if you are driving, this can be critical.

The difference in the effect of glare on daytime and nighttime vision is caused by the fact that we use a different part of the eye for seeing at each of these times. During the day, we see with the cones of the retina; at night, we see with the rods. It is the rods of the retina that contain the pigment, rhodopsin, that enables us to see at lower levels of illumination.

Trouble at night

There are two ways in which night vision is affected by glare: one is a carryover from glare experienced in the daytime; the other is direct glare experienced at night. The former may make it difficult for you to adapt to night vision; the latter provides its more immediate physiological problems.

If, during the daytime, your eyes are exposed to glare, the rods of the retina (although they are not used for seeing during the day) also get excessive light exposure along with the rest of your eyes. Overall retinal fatigue may set in and affect your ability to perceive objects. If you're driving at night, this may be serious. Eye-care authorities recommend that you wear sunglasses in bright

light during the daytime. This is particularly true when you are at the beach where glare is intensified by reflections from sand and water. With glare protection during the day you'll avoid the problem of eye fatigue, and you'll be able to see better after the sun goes down. But take off your sunglasses at night—since they can cut down on your visibility.

Slow reaction

The second, more immediate, effect of glare on night vision is that experienced directly when you are driving—glare of oncoming headlights. After exposure to a glaring light, there is a mechanism in the retina that sometimes does not permit it to react to a form, image or size right away. This, too, is a phenomenon due to retinal fatigue.

Special "glare recovery" instruments have been developed to measure this definite period of time-lag between exposure to glare and your ability to see, which differs in different individuals. The normal range of recovery is a few seconds from the time you are exposed to glare. Many individuals, however, have dangerously longer periods, up to 15 seconds or more, when they simply cannot see anything. This is a long time, if you're driving and have to react to a situation in split seconds.

With glare a potentially grave problem both day and night, you may need professional advice on how to guard against it.

Wearing sunglasses does not mean you have "gone Hollywood." It simply makes good sense.

At an experimental farm in Israel's Negev desert, stone terraces and dams on the highlands are used to channel rain water from the slopes to the cultivated fields below.

STONES THAT MAKE THE DESERT BLOOM

Today the Negev desert is a wasteland. But civilization once flourished there. An Israeli professor has gone to the Negev to try to rediscover the ancients' secrets of giving the arid desert life.

THE forbidding Negev desert in southern Israel once supported a flourishing civilization. The Nabateans who lived there 2,000 years ago had six cities with populations totalling 100,000 in the desert, and before them the ancient Israelites successfully lived in the region. With all his scientific advancements, modern man has been unable to establish himself successfully in the Negev. How did the ancients manage to survive in this wasteland?

One theory is that the climate has changed drastically in the past 2,000 years. But this theory is rejected by Michael Evenari, for many years professor of plant physiology in the Hebrew University in Israel. He points out that the ancient buildings were made entirely of stone—indicating a lack of trees and he says there is evidence that the dwellers in the Negev carefully collected every drop of rain—again consistent with arid conditions.

To test his theories of how these ancient farmers lived, Professor Evenari, his wife, and eight others have gone to the desert to live.

The Negev highlands consist of rugged desert slopes cut by narrow ravines, or wadis, leading to the plains below. The soil on the slopes is very salty and shallow; but wadis contain a type of soil called loess, uninviting in appearance but in fact fertile. The rainfall in this region is concentrated in a few savage winter storms which may produce three to five inches of rain, clearly insufficinet to support human life.

The intention of the ancients

For years, Professor Evenari searched the area looking for evidence of how the farmers fashioned fertility out of the desert. The most important evidence was mysterious clusters of stone, known as "tuleilat al-anab" or grape mounds, scattered along the hillsides. What had been the ancients' intention in piling these mounds? There was other evidence, the slopes yielded signs of terraces, channels and spillways. Yet the soil of the slopes was incapable of supporting vegetation.

Professor Evenari's explanation is this: the purpose of all these structures was to bring the maximum amount of rainwater down into the plain. The stones that covered the slopes held the raindrops and prevented a free flow; therefore the farmers concentrated the stone in a few places to leave the slopes clear for the water to run down to the bottom of the wadi. The "desert pavement" of the slopes, when cleared, formed a hard crust which was impermeable to water. By controlling the rushing waters through channels, spillways and terraces, which also protected the land against erosion, the ancients managed to collect almost every drop of rainwater and concentrate it in the farms below.

Thus the farms were watered by rain which fell in areas often ten times the size of the farming units. A five- or seven-acre farm would receive the rainwater from an area of 50 to 70 acres. This meant that a rainfall of 3 inches could form the equivalent of 30 inches.

This theory was supported by knowledge of the desert "flash floods." During a desert rainstorm the wadis, normally empty, can become wide, raging torrents.

Professor Evenari re-created in his mind's eye the Nabatean farm at the foot of the wadi. To bring his vision to reality, he sought a suitable model. He eventually found one in a farmhouse at Abte.

With funds from the Ford Foundation and other agencies, he and his associates have prepared a four-acre area of terraces complete with spillways, and a master-channel running alongside the terraces with control gates to furrow the water into terrace after terrace.

If time vindicates Professor Evenari's theory, he will be like King Uzziah of the Bible, who "built towers in the desert, and dug many wells."

KFS

What's biting you?

by Lucile Evans Steinmetz

MOST of us swat mosquitoes, admire butterflies and enjoy eating honey. But how much more do you know about our six-legged friends and enemies?

1. The principle of jet propulsion is employed for a quick getaway by a:
   a. Water scorpion
   b. Mosquito larva
   c. Dragonfly nymph

2. What is the longest-lived insect in the world?
   a. Cicada
   b. Clothes moth
   c. Scarab beetle

3. What insect caused some of Napoleon's soldiers to be abandoned along the road of retreat in Egypt?
   a. Mosquito: carrier of yellow fever
   b. Tse tse fly: carrier of sleeping sickness
   c. Flea: carrier of the bubonic plague

4. Which of these produces a red dye used in old-fashioned rouge?
   a. Ladybug
   b. Cochineal
   c. Red ant

5. The insect imported from Australia that saved the citrus industry in California from a scale insect was:
   a. Praying mantis
   b. Stink bug
   c. Ladybird beetle

6. What insect hears sounds inaudible to the human ear?
   a. Grasshopper
   b. Termite
   c. Honeybee

7. What allows a water strider to walk on water?
   a Webbed feet
   b. Surface tension
   c. Oiled foot pads

8. Which of these butterflies is distasteful to birds?
   a. Viceroy butterfly
   b. Monarch butterfly
   c. Swallowtail butterfly

(continued on next page)

9. Louis Pasteur saved the:
   a. Beeswax business
   b. Citrus fruit culture
   c. Silkworm industry

10. Which insect carries the fungus that causes Dutch Elm disease?
   a. Ant
   b. Wasp
   c. Beetle

11. Which insect employs an aqualung?
   a. Water scorpion
   b. Diving beetle
   c. Damselfly larva

12. Beeswax is used in the manufacture of:
   a. Carbon paper
   b. Litmus paper
   c. Fly-paper

13. Which insect has "cows"?
   a. Grasshopper
   b. Boll weevil
   c. Ant

14. What kind of insect causes trouble for the telephone company by boring into lead cables?
   a. Termite
   b. Short-circuit beetle
   c. Carpenter ant

15. Crickets are unusual insects in that their ears are located:
   a. Above their eyes
   b. In their front legs
   c. Under their wings

16. What insect uses a snorkel?
   a. Mosquito larva
   b. Dragonfly
   c. Diving beetle

17. Which of these insects bites you?
   a. Female mosquito
   b. Male mosquito
   c. June bug

18. An important ingredient of shellac comes from what insect?
   a. Aphid
   b. Chinch bug
   c. Lac scale

19. What insect cannot eat?
   a. Mayfly
   b. Hornet
   c. Lacewing fly

20. You can't take a Katydid's pulse because of:
   a. His agility
   b. Toughness of skin
   c. Small size

ANSWERS

1. **"c"**—Dragonfly nymphs can draw water into their abdomens and expel it, shooting themselves forward rapidly.

2. **"a"**—The total life span of the seventeen-year cicada (commonly called locust) including the seventeen years the nymphs live under ground makes it the longest-lived insect.

3. **"c"**—Fleas bit infected rats, then bit humans.

4. **"b"**—Cochineal insect was collected, dried and sold by the pound to cosmetic manufacturers.

5. **"c"**—The ladybird beetle keeps the cottony cushion scale insect under control.

6. **"a"**—Grasshoppers can hear over 30,000 vibrations per second. The termite and the honeybee are deaf.

7. **"b"**—Its feet do not penetrate the water film.

8. **"b"**—Monarch's bitter flavor saves it and the Viceroy as well, since Viceroy mimics Monarch in appearance.

9. **"c"**—Louis Pasteur bred silkworms immune to the disease that was killing the silkworms of France.

10. **"c"**—A tiny bark beetle is the villain.

11. **"b"**—Before diving it traps air under its hard wing covers. This air bubble serves for underwater breathing.

12. **"a"**—Used in making colored pencils, too.

13. **"c"**—Aphids are the ant "cows." The ant gets a honey-like substance from them.

14. **"b"**—The opening made by boring allows moisture to reach the copper wires and short them.

15. **"b"**—The tympanum or ear is located just below the "knees."

16. **"a"**—The mosquito larva (wriggler) hangs head downward from the water surface and draws in air through a breathing tube.

17. **"a"**—Male mosquitoes eat plant juices and nectars.

18. **"c"**—This insect from India covers itself with resin. It is collected in great quantities. The lac resin is dissolved in alcohol to make shellac.

19. **"a"**—The mouth of the adult Mayfly is useless or lacking. But since Mayfly lives for such a short time it does not need to eat. It dies after the nuptial flight.

20. **"b"**—No pulse could be detected in the leg. Insects live in armor.

Score Yourself:

0-10: You're no expert, but you probably know enough not to anger a wasp.

11-18: You know your bugs, and should know that not all insects are bugs.

19-20: How many legs do you have?

Will this some day run your car?

PORTABLE electrical power has undergone revolutionary changes since the advent of the fuel cell. Like a battery, the fuel cell generates a smooth, silent flow of power through a chemical reaction. But unlike the battery, it doesn't have to be recharged. As long as fuel lasts, it surges on at peak power.

Many observers see the fuel cell as an automobile powerplant of the future or a powerpack for appliances. The exhaust is harmless, and it will send you twice as far on a gallon of fuel as present engines.

Until now, however, cells have been potential bombs run on hydrogen, a touchy super-fuel used for rockets, or Tiffany-priced creations of exotic high-temperature materials.

Recently, two General Electric chemists, Dr. Willard T. Grubb and Dr. Leonard W. Niedrach (left), brought a practical fuel cell a car-length closer by using common fuels like gasoline, diesel oil or natural gas at moderate temperatures.

To turn this trick, they resorted to a costly platinum catalyst. So even Uncle Sam can afford fuel cells for only special jobs. One will ride along with two astronauts in the Gemini spacecraft.

Until the price comes down to earth, the fuel cell won't either, a GE official cautions.

How long will that be? At least not "before the next decade."

What do you really believe?

WOULD you rather be dead than red?

Most Americans, it seems, would prefer the state of redness to the state of deadness. So says Dr. Milton Rokeach, Michigan State University professor of psychology.

The reason, he explains, is that the deep-rooted, primitive belief, "It is better to be alive than dead," would be stronger than the peripheral belief, "it is better to be anti-Communist than Communist."

Dr. Rokeach contends that all beliefs fall into four distinct groups of varying strengths:

At the center are "primitive beliefs." These are beliefs a person holds because everyone in a position to know holds the same belief—such as Dr. Rokeach's belief that he is Milton Rokeach, an American, an MSU psychologist, etc. These are beliefs commonly taken for granted.

In the next circle are the authorities one believes in. These "authority beliefs" are the references a person judges to be reliable—the Bible, father, mother, the Constitution, the Democratic or Republican party, etc.

In a third circle are beliefs a person holds because they stem from a respected authority. Known as "peripheral beliefs," they include ideologies.

In a fourth circle are "inconsequential beliefs"—"Summer is better than winter," for example.

One of the tests of his theory was an experimental poll with the slogans, "better red than dead," and "better dead than red."

Dr. Rokeach and his assistants found that 60 percent of the subjects interviewed did not believe that "Death is preferable to living under a Communist regime." The 40 percent who agreed with the statement, however, were persons who thought war was highly improbable, Dr. Rokeach noted.

Dr. Rokeach found that under hypnosis persons could be persuad-

ed to change some of their beliefs and even become more favorably inclined to political beliefs they normally oppose strongly. However, they resist changing their more deep-rooted primary beliefs.

Psychology for safety

New York City is using mass psychology in an attempt to keep drivers and pedestrians from killing or being killed in traffic.

New Yorkers will be exhorted to unwind their hostilities, tensions, and exhibitionism some place other than on the city's streets. The Department of Traffic has called in the Postgraduate Center for Mental Health in an attempt to find out what underlying emotional factors result in traffic accidents.

Dr. Lewis R. Wolberg, medical director of the center, conceded that the prognosis for the experiment was uncertain.

He said that the center was donating its services because past safety education campaigns that "appealed to reason and common sense didn't have sufficient impact" on the accident picture.

Dr. Richard Firestone, staff psychologist assigned to the project, said, "Our first step is to make people aware of the real problem to bring it out in the open and to get people to talk about it.

"As a second step, we will employ slogans, humor and other devices to heighten public awareness of how underlying emotional conflicts interfere with sensible behavior in traffic situations."

Dr. Firestone gave the example of a motorist who was "angry at his wife, girl friend or employer." His hostility, the psychologist said, should be directed at the person.

"To transfer this hostility to the car or pedestrian ahead is not only a flight from reality," he said, "but is obviously dangerous behavior."

How ghettos destroy people

Modern psychiatric treatment can not hope to cope with the mental destruction spawned by racial ghettos, says Dr. Kenneth B. Clark, psychology professor at the City College of New York.

By concentrating on individual treatment and diagnosis psychiatry too often ignores the environment that produces aberration, Dr. Clark says. A high proportion of social deviates must "be understood in terms of an understanding of the social pathology within which these individuals are required to live."

An individual is socialized by his environment, and "to grow up in a community dominated by the symptoms of injustice" is to be damaged. "In its essence, the ghetto is a compound of despair, inertia apathy, seething frustration, latent

turbulence and chronic covert and occasional overt violence." He adds: "The pervasive patterns of racial segregation which dominate large areas of American life damage and make ineffective the personalities of its victims" and create deep feelings of inferiority in Negro youth.

"It depresses their motivation, constricts their vision and lowers their educational and vocational aspirations. Some of these young people seek to maintain a positive image of themselves through hostility and random or organized aggression and other antisocial acts.

"A complex pattern of withdrawal, hypersensitivity, self-hatred, fantasy, self-serving rationalizations, exhibitionism, hostility and submissiveness may be found among all human beings who are systematically humiliated and denied that minimum opportunity and dignity essential for effective humanity."

New hope for the aged

"Some remarkable changes are being seen by psychologists working with the aged today, New York psychologist Dr. Muriel Oberleder reports.

"So-called vegetative elderly persons in mental hospitals, for example, can be revived and quite unbelievable changes can take place in their adjustment potential by putting them to work in some useful task."

The so-called "irreversible" changes like the loss of memory, the "inflexibility" of the aged, which in the past have been considered an inevitable part of aging, are now being seen as being among the consequences of anxiety and stress, she says.

"There is an urgent need today," Dr. Oberleder adds, "to break down popular misconceptions about the aged generally held by professionals as well as the public."

"Even memory losses," she points out, "can be reinstated when anxiety is lowered."

Are tranquilizers overused in hospitals?

Mental hospital wards today are quiet—sometimes so quiet it's "creepy."

"When it is like that," said Dr. O. R. Yoder, Superintendent of Ypsilanti, State Mental Hospital, Michigan, "I get the feeling that we've failed to give the patients what they really need. We want to cure the mentally ill; we don't want to tranquilize them into immobility."

Today many medical authorities are concerned about the possible overuse of tranquilizers in mental hospitals. To be sure, Dr. Yoder states, the discovery of tranquilizers was a major medical advance, for it has all but abolished the strait jacket.

But there is another aspect: Today, tranquilizers are so effective in calming the patient that too many doctors tend to think of them as a kind of easy solution to the entire problem, with the result that further research into the cause of mental illness in in danger of being cut off.

Dr. Yoder says that state hospitals like Ypsilanti annually spend about three times as much for tranquilizers as for all other expenses combined.

At present, virtually all of the more than half a million Americans in mental hospitals receive some form of tranquilizer. A moderate daily dose enables a mildly disturbed person to lead an almost normal life. The psychotic, or seriously ill person, requires a larger dose which often makes him so lethargic that he is little more than a human vegetable.

Dr. Yoder feels that the problem is how to reduce tranquilizer usage while maintaining its laudable results.

Seeing through the skin

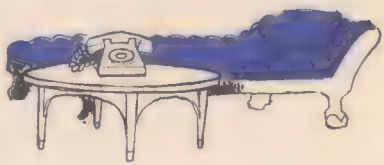
Soviet scientists believe that approximately one out of six persons possesses an ability to distinguish colors of objects and designs on fabrics by touch.

Professor A. N. Leont'yev of the Physiological Laboratory of Sverdlovsk Pedagogical Institute has developed special experimental methods utilizing an apparatus to determine whether the optical sensitivity of the skin can be developed in blind persons, and in persons with normal vision.

Similar studies are also being conducted at the Nizhnyy Tagil Pedagogical Institute by Dr. A. S. Novomeyskiy and Dr. I. M. Gol'dberg, with special interest in the possibility of developing skin vision in persons with poor eyesight.

The doctor is always in

You can dial-the-weather, dial-the-time and even dial-a-prayer. Now in Philadelphia you can dial-a-psychiatrist.



An emergency service instituted by the Philadelphia Mental Health Clinic allows a patient, family or friend to get in touch with a psychiatrist by phone at any hour of the day or night.

The purpose of the service is to help those requiring immediate psychiatrist attention get through "potentially explosive situations."

Dr. Cecil Harris, director of the clinic, said that the service would help, among others, persons suffering from acute anxiety, those who attempt or threaten suicide, persons behaving violently because they are undergoing acute psychic episodes and those in an extreme state of depression. It would, in essence, provide a safety valve in moments of crisis.

Is any anesthetic safe?

by Charles Marwick

**Anesthesia—man's triumph over pain—
represents one of the greatest medical advances in history.
Yet these pain killers can be dangerous—even deadly.
And new anesthetics present new dangers.**

THEY were both comparatively simple operations.

The teenage girl had been operated on ten days before to stitch up a deep cut in her wrist which she had gotten from falling into and shattering a glass door.

A man in his sixties had two operations for perforated ulcers within ten days of each other.

Both patients had appeared to be getting along quite normally in the first few days after surgery.

It was not until some time later that their temperatures rose, they became unable to urinate, and laboratory tests showed that something was very far wrong. No treatment seemed to help them, and a few days after their operations both patients died in agony.

No treatment seemed to help them, and a few days after their operations, both patients died in agony. . . . What had happened?

In postmortems, doctors found that both these patients had been essentially normal except for their livers. More than four-fifths of the girl's liver was destroyed. The man was an alcoholic and might have had some previous liver damage, but not enough to kill him. Yet, in both cases, liver damage was clearly the cause of death. What had happened?

At the end of the last century, chloroform was found to be highly poisonous to the liver, and the doctors were struck by the similarity of these deaths to deaths from chloroform anesthesia. But both patients had been given a relatively new anesthetic substance called halothane.

Soon other links between this new anesthetic and possible liver damage were discovered. Doctors in Ann Arbor, Michigan, reported four cases of liver damage in association with halothane. Three of the patients died.

Four years ago, two other anesthesiologists reported a death after using this anesthetic.

Today, there are certainly ten deaths in the United States that are known to have occurred following the use of halothane and many instances of liver damage from which the patients eventually recovered.

"It renders the anesthetic at least suspect," say Drs. John Lindenbaum and Edgar Leifer of New York's Columbia University College of Physicians and Surgeons. "It is beyond the realm of mere coincidence," editorialized *The New England Journal of Medicine*.

Halothane was first made in Britain in 1951. After extensive testing and trials, it was finally approved for use in the United States in 1956. In a general way it is chemically similar to chloroform, both being what chemists call halogenated compounds. It is very potent, being readily soluble in the blood and tissues, and under today's conditions in the operating room it is relatively easy to manage. But its most important quality is that it is non-explosive.

The greatest danger from anesthetics before halothane was explosion. It has been estimated that in the 1940s as many as 50 and 60 explosions occurred in operating rooms every week. As if to point up this danger, less than a month

after these reports incriminating halothane appeared, a patient was killed in an operating room explosion in New York. In this case the anesthetic used was one of the most popular agents employed before halothane came on the market, a substance called cyclopropane.

Poisoning; heart stoppages; explosions and now poisoning again. This is the story of anesthesia. The plain truth is that no anesthetic is completely safe. To a greater or lesser extent, depending on the skill of the anesthesiologist and the condition of the patient, all are dangerous. This is why the search for the ideal anesthetic still goes on even though when it first appeared halothane was hailed as "the perfect anesthetic."

A range of choices

Today, if you go into a hospital for an operation, the anesthesiologist, who is a highly trained medical specialist, will probably use one of three main types of anesthetic: a volatile liquid such as chloroform or ether; a gas such as nitrous oxide, cyclopropane or halothane; or an injection of a drug such as sodium pentothal, the anesthetic that was so widely used in the armed services during World War II.

The choice will depend on the nature of the surgery and the type of person you are. If you suffer from bronchitis or have a lung condition, he may decide not to use ether because it irritates the windpipe and stimulates secretions which might flow into the lungs and cause pneumonia. But even so, he still might prefer to use it mixed with oxygen if you are undergoing chest surgery because it depresses the activity of certain nerves, making it easier for the surgeon to operate in this region.

Advantages and disadvantages

On the other hand, chloroform does not irritate the bronchial and lung tissues. Your muscles relax more completely under it—which is important to the surgeon—and it has the virtue of being nonexplosive. Yet because it is so poisonous these advantages are entirely offset.

Ether is explosive and although in a modern hospital proper precautions are taken, there is always the outside chance of an accident.

By far the most common anesthetics in use today are the gases and the oldest of these is nitrous oxide. In many ways this substance is an excellent candidate for the perfect anesthetic. It is nonirritating, it does not combine chemically with any part of the body's organs or tissues, but it is not very powerful either. This means that it has to be used in such high concentrations that death from lack of oxygen can result. To prevent this, the gas is given with oxygen—usually in the proportions of about 80 per cent nitrous oxide to 20 per cent oxygen. But this poses another problem for the anesthesiologist, because now he may not be able to get you suffi-

ciently anesthetized for the surgeon to operate safely. So to overcome this, he gives you a shot of morphine with scopolamine or atropine to enhance the effect of the anesthetic.

The most potent of the presently used gases is cyclopropane. Its anesthetic properties were discovered largely by accident in 1929 and since the mid-1930's it has been one of the most popular anesthetics until the advent of halothane.

For a smooth recovery

Cyclopropane does not irritate or injure the liver and kidneys, recovery is smooth and you do not get nearly as nauseous as you do after ether. The surgeon likes it because it gives greater muscle relaxation than the other anesthetic gases. But cyclopropane has a serious disadvantage—it is both inflammable and highly explosive.

The third main form of drug used in general anesthesia is a member of the barbiturate family, thiopental sodium, or sodium pentothal as it is more popularly known.

This is simply injected into a vein. It is probably one of the pleasantest ways to be anesthetized. You simply fall asleep, often quite suddenly, and there are few, if any, after effects.

The danger is that sometimes the breathing mechanism is depressed and if the anesthesiologist does not watch carefully, his patient may die from lack of oxygen. For this reason he usually puts a tube in the mouth and down the windpipe so that he can give his patient oxygen during the operation. To prevent coughing, hiccoughs and constriction of the lower parts of the windpipe, you will probably get an injection of atropine or scopolamine before the pentothal shot.

Another problem with these anesthetics is that once they have been injected into a person there is no direct way to stop their effect. Unlike the gases or the volatile liquids which are given continuously during the operation, the anesthesiologist has no moment-by-moment control. Pentothal, once it's in the blood stream, will continue to act until it has been eliminated. Again, there is no way for the anesthesiologist to estimate in advance how much will be needed by a particular patient. In practice, of course, his experience tells him how much he will probably need and he can always give booster shots during the operation if required.

Anesthesia by electricity

One unique and brand-new type of anesthesia is being used at the University of Mississippi—a high frequency electric current. Electrodes are strapped to either temple and an amplifier is used to bring the current up slowly to 700 cycles (ordinary house current is usually delivered at 60). The voltage usually runs from 20 to 30, and the intensity is at 50 milliamps. So far there has been no evidence of brain damage or other ill effects with this

Lack of knowledge concerning the mechanism of an anesthetic is nothing new. In fact, no one is exactly sure how any anesthetic works.

procedure which has been used for several operations. How it works is something of a mystery although it is probably connected with the ability of an electric current to depolarize the nerve membranes in the central nervous system. But lack of knowledge concerning the mechanism of an anesthetic is nothing new. In fact, no one is exactly sure how *any* anesthetic works.

However, this latest attempt to use electricity to anesthetize is only another step in the constant search for better and safer drugs in general. Halothane has been definitely associated with ten deaths and a number of cases of liver damage, yet it has been given to an estimated 10 million Americans since 1956. One case in a million is not a bad average.

To find out for certain whether or not halothane is to blame for these few cases, eleven hospitals around the country are participating in one of the largest investigations of an anesthetic ever undertaken.

The records of every case of routine general surgery will be sent to Dr. John P. Bunker at Stanford University in California who will process the information on a computor and compare each type of anesthetic in an effort to detect any significant difference between those who receive halothane and those who do not.

"If there is any real difference," says Dr. Bunker, "we might pick it up in the first few thousand cases. If this happens we'll report it immediately. However, if no difference is spotted we'll go right on with the study for 100,000 cases and if liver damage occurs less than once in that number it would be a negligible risk."

The chances are, however, that even if halothane is incriminated, by that time another anesthetic will have become available. Already a new variant of halothane and chloroform, methoxyflurane, is being widely used by some anesthesiologists.

Safety in numbers

This is part of the answer to the undoubted dangers of anesthesia—multiplicity of anesthetics. Up to a point, the more anesthetics there are available the less danger there is from these highly dangerous agents. It gives the specialist a wide choice, allowing him to "tailor" his anesthetic, as it were, to the individual case.

Yet even when considerable risk is involved, it is well to remember that if there were no anesthetics there would be no surgery as we know it today and a great deal of medical practice would still be in the dark ages.

Make a dime fly

THESE days money doesn't go as far as it used to. Here is how to make a dime go farther than you would have thought possible.

Lay a dime on the table about half an inch from one edge. Put a saucer a few inches beyond it, as in the drawing. Blow a sudden, strong blast of air across the top of the dime. It will jump into the dish.

This and many other things that happen when air moves rapidly can be explained by a simple rule: The faster a stream of air moves, the less it presses on anything alongside it.

Things seem to be sucked into a stream of moving air because normal air pressure on the side is stronger and pushes the objects into the moving stream. This is what happened when you blew a stream of air across the top of the dime. The coin was lifted into the air stream, which then blew it over into the dish. The same thing happens when a hurricane lifts off the roof of a house.

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They love their swamp

by Creighton Peet

A swamp is a forbidding place to many people, but to residents near New Jersey's "Great Swamp," it's a biological showcase. To preserve their swamp, they have raised over half a million dollars and earned the applause of the Secretary of the Interior.

MINUTE by minute, more acres are being bulldozed into suburban developments, factory sites, and highways. Our national birthright of primeval forests and unpolluted streams is vanishing. Even the few samples of these unspoiled areas conservationists want to save for the study and enjoyment of future generations must be fought for with money, perseverance, and above all, speed.

Speed has been of prime importance to a handful of men and women racing to save the Great Swamp of Morris County, N. J., for a 3,000-acre wildlife refuge. Located in the

Condensed from *American Forests*, March 1963. Copyright 1963, by the American Forestry Association, 919 17th St., N.W., Washington 6, D. C.

This swamp area is in the center of a community 25 miles from New York City.

Photo: Molly Adams

center of a rapidly growing suburban community only 25 miles from New York City, this Great Swamp still holds an incredible number of survivors from pre-historic America.

In addition to 165 species of waterfowl there are whitetail deer, fox, mink, otter, raccoon, muskrat, etc. There are also some 80 species of plants including laurel and rhododendron on the sandy ridges, lilacs in the meadows, and orchids in the wetlands. For generations the swamp's blueberries have been famous. Once heavily wooded, there are still some ancient white oaks three to five hundred years old, as well as stands of beech, whitewood, locust, ash, sassafras and many other trees. The area is drained by four brooks, and is one of the few areas of unpolluted wetlands along our Eastern seaboard. It is an important resting and feeding place for migrating birds along the Atlantic Flyway. Most of the terrain between Maine and Virginia is now rapidly growing into a vast urban complex.

Creeping suburbia

There have been times in the past few years when it hardly seemed possible to move fast enough to save this natural area, but by February of this year the Great Swamp Committee of the North American Wildlife Foundation, with the support and encouragement of Secretary of the Interior Stewart L. Udall, had raised funds to buy 2,081 acres. Negotiations for the purchase of the remaining 919 acres needed to provide a manageable wildlife refuge are under way, and it is expected they will be completed this fall.

While the very name "Great Swamp" probably has made many real estate developers slow to venture into its depths, for years now bulldozers and surveyors have been working as close to the swamp as they could get. They have added dozens of expensive, well-built houses to the open spaces between the eight long-established villages located on the hills which surround the depression in which the Great Swamp lies.

This hollow was formed by the retreat of the Wisconsin Glacier at the end of the last ice age, some 10,000 years ago. Today the Great Swamp drains into the Passaic River and performs a valuable flood control function, the spongy terrain holding excess water and allowing it to drain away slowly.

Actually, the term "Great Swamp," which goes back to pre-Revolutionary times, is quite misleading, for in addition to the quicksands and the wild, marshy meadows in which a man will sink up to his waist, there are a number of high, sandy ridges, and ancient forests. A couple of small villages and several settlements in which there are houses well over a hundred years old are located in its depths.

Today this swamp is traversed lengthwise by a blacktop road, while two other roads cross it in the opposite direction. Also, the towers of a high tension electric line march

Photo: Molly Adams

Future plans for the Great Swamp include a 30-acre nature center where school children can be brought for lectures and walks.

diagonally across it, and a pipeline bringing gas up from Texas to New York City burrows under it. All this is despite the fact that in many places the watertable is but a few inches below the surface, and that after heavy rains many areas are flooded.

Once densely wooded, the swamp was cut heavily by previous generations for building materials. But recently the forests have started to come back.

When the Port of New York Authority considered the swamp for a metropolitan jet airport in 1959 the Great Swamp Committee was organized for fast, intensive action.

How much money did the committee collect from Americans who are supposed to have no interest in anything which does not show a quick profit? By January some $550,000 had been received, with the committee still working for an additional $300,000 to complete the purchase of the entire 3,000-acre area. (While the Fish and Wildlife people have said they can have a manageable refuge with 3,000 acres, they would much prefer 6,000 acres —but this is going to take a little longer.)

On Nov. 27th of last year, Secretary Udall appeared at a dinner meeting of the Great Swamp Committee to congratulate the committee and speak on the importance of this area for future generations.

Need for nature

"No one but a Thoreau," Udall said, "could have dreamed even 25 years ago of the significance that swamps and their values in wildlife and nature's freedom would assume in the minds and hearts of city-bound men. It is perhaps because more and more each day sensitive men feel a need for the healing solitude of nature.

"Let us hope this recognition has not come too late. For in the world of nature, paradise lost cannot be regained.

"Here in New Jersey . . . where people are crowded more densely than anywhere in the United States —you have had the foresight to dedicate 2,081 acres of your precious land to its highest use—perpetuation in its natural state."

As for future plans for the Great Swamp, John S. Gottschal, regional director for the Fish and Wildlife Service, envisions a 30-acre nature center deep in the swamp to which groups of school children can be brought for lectures and walks—using only carefully laid out paths. Already casual visitors have started pouring into the area in summer, and to keep it from becoming littered and overrun with careless people who will pick (and, experience has shown, dig up) flowers and plants, a resident manager and wardens will be essential.

Serious college students and scientists will, of course, be permitted greater liberties in the swamp, but it is planned to set aside certain areas in which no visitors will be allowed. But there will also be observation towers at various locations, to give an idea of what the swamp looks like as a whole.

Up from the fish — and back again

"WE ARE now moving toward an alteration of human anatomy to give man almost unlimited freedom underwater," says Capt. Jacques-Yves Cousteau. Since the mid-30's, when he first donned a diving mask, the French ex-naval officer has spent much of his life under the sea. He instigated the design of the Aqua-Lung and a two-man submarine for scientific exploration at 1000-foot depths. Last year two men on his diving team spent a week under water using a cylinder eight feet in diameter as a base.

Now it is time "to place swimmers underwater for very long periods to really learn something about the sea," Cousteau says. "I think there will be a conscious and deliberate evolution of *Homo aquaticus*," a man equipped by surgery to make his first home the ocean.

In an article by James Dugan in *The New York Times Magazine*, Cousteau explained how this could be done. United States space doctors have suggested leading the blood out of the body through an external blood oxygenator. This artificial "gill," bypassing the human lungs, would leave them subject to collapse underwater. This may be overcome by packing the rib cage with a noncompressible, sterile plastic," Cousteau adds. "Of course, an even better way to produce Homo aquaticus would be to make a real manfish. He would inhale water instead of air, just as a fish does. There would be mechanical assistance to extract oxygen from the water."

Why not? he wants to know. "During the first nine months of human life we grow while immersed in fluid in the womb."

You can invent by accident

Not all scientific advances have been the result of careful, patient investigation. Sometimes great discoveries have resulted from simple mistakes.

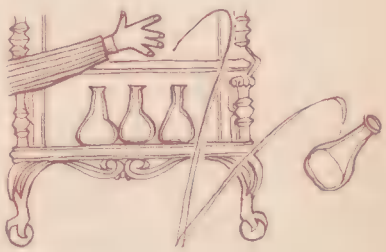
by O. A. Battista, Sc.D.

"THERE is a greater need than ever before," says scientist Dr. Roland W. Wright, "for happy accidental discoveries. Even in this twentieth century you still may find things you do not set out to search for. World-shaking scientific and medical developments continue to drop from out of the blue."

History is filled with important discoveries which resulted from a mistake or an accident.

Charles Goodyear conducted rubber experiments for years, yet not until he absent-mindedly spilled a mixture of sulphur and rubber onto a hot stove did he find what he was looking for. It was then that he discovered that when rubber is mixed with sulphur and heated, it undergoes changes that cause it to lose its stickiness and give it new properties of increased tensile strength and higher elasticity. This process became known as "vulcanizing."

In 1903 a French chemist, Edouard Benedictus, was working in his laboratory when he happened to knock a flask containing a celluloid mixture off a high shelf. The flask crashed to the floor, but Benedictus noticed that although the glass was



When a flask with celluloid in it fell but did not shatter, Edouard Benedictus learned how to make splinter-proof glass.

cracked it had remained in one piece.

On closer examination he found that the celluloid had formed a thin coating on the interior of the flask and it was this which had held it together. From this accident he conceived the idea of making a "sandwich" of two pieces of glass with a sheet of nitro-cellulose between them, and thus was discovered splinter-proof glass which has brought safety to millions in a variety of forms, including automobile windshields.

Multimillion dollar heel

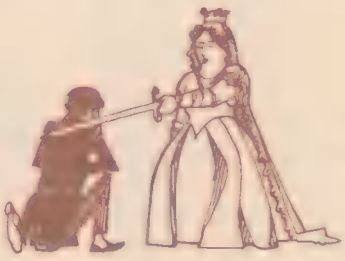
More than fifty years ago a man named Daniel O'Sullivan, tester of electrical equipment, had to stand on a rubber mat to keep from shocking himself. But he occasionally forgot and stepped off the insulation, much to his discomfort. Daniel finally came up with the idea of taking his insulation with him. He fashioned himself a pair of rubber pads and glued them onto his shoes. These not only kept him safe, but he found that the springy rubber was pleasant and comfortable to walk on. And from this came his big idea: the multimillion dollar idea—the rubber heel.

One day, a young man stood waiting for a street-car in Washington, D.C. He picked up a hair pin from the sidewalk, idly bent it around his fingers. It suddenly occurred to him that this piece of wire, properly bent, could be used to hold papers together. That marked the birth of the paper clip and a large fortune. The chap had never invented anything before in his life; like thousands of others, he was a one-shot inventor who struck it rich because he did something about a chance observation.

A young Scottish lad by the name of Henry Perkin was home on Easter vacation from college. He was only 18 at the time. In the attic of his father's house, he built himself a tiny laboratory. He wanted to find a way to make synthetic quinine out of coal tar derivatives.

He mixed compounds with fine zest and abandon. All he got in the bottom of his test tubes was a black sticky mass. Cleaning them out with alcohol, he noticed that one of them turned a beautiful delicate purple. Would this make a good dye?

It did. It became the first important artificial dye in history. It ultimately reached such heights of popularity, in fashionable dresses and decorations, that it lent its name to a whole period—the Mauve Decade. Henry Perkin became rich.



Henry Perkin's discovery gave its name to an era. Rich and famous, he was knighted by Queen Victoria, but his discovery was more important than he knew.

He was knighted by Queen Victoria. But his discovery had scarcely begun to play its historic role in the drama of scientific progress.

Louis Pasteur could not have done his work if Henry Perkin had not first made his discovery. It was found that coal tar dyes could stain bacteria selectively, thereby making possible the accurate study of microbes under the microscope.

Disarming a microbe

Pasteur benefited more directly from accidental discovery. In 1880, he was studying chicken cholera. The germ of the disease was already known but not the method of preventing the disease. Pasteur grew the germs in a broth of chicken gristle and soon had a plentiful supply, which in small quantities quickly and invariably killed chickens. He knew that the culture had to be made fresh each day to be potent. Through an oversight, several-weeks-old culture was used one day. The hens injected with it developed cholera—but instead of dying as expected, they recovered. When these same hens were later infected with fresh, virulent cholera germs, they did not get sick, whereas hens of another group all promptly died.

Out of this chance accident grew one of Pasteur's greatest findings—that disease-producing microbes may be caused to lose their virulence—and from the "disarmed" microbes, vaccines may be made that will prevent the development of the same disease when animals or human beings are exposed to them in the usual manner.

In Australia a group of investigators recently were studying a destructive skin disease. In the sores, they found large numbers of germs that looked and acted exactly like tubercle bacilli, except that they would not grow in the laboratory on culture media on which other tubercle bacilli thrived. One night the heat-regulating mechanism of the incubator in which the germs were cultured failed and the temperature, normally maintained at 37.5° C (body temperature), dropped to 34. Surprisingly, the next day there was a vigorous growth in the cultures. The research workers followed a hunch and found that this germ was acclimated to a colder temperature than the bacillus that causes lung tuberculosis. It multiplied readily on the hands exposed to the weather but not under conditions similar to those present in one's lungs. Having learned the reproductive likings of these bugs, the researchers promptly succeeded in prescribing effective medication to eradicate them.

A fox has the answer

Cotton plants grow well and abundantly in the rich black soil of the Carolinas, Georgia and Alabama. But for many decades the short fibers were difficult to separate from the seeds to which they clung. Among the thousands who pondered over the solution of this mechanical

A greedy fox stalking a chicken showed Eli Whitney that sometimes an animal can outdo even Yankee ingenuity.

problem was a Yankee, Eli Whitney. He made a chance observation that supplied the missing link to the cotton gin. One night he noticed a fox crawling at a chicken in a coop. The fox managed to reach his paw between the narrow slats of the coop, but could drag out only a cloud of feathers, not the chicken. Whitney had it! He constructed a clawlike rake whose prongs reached between the bars of a grid fixed in a hopper filled with cotton balls. The white, silky threads were torn out and the seeds left behind.

Marble now has its six hundred different hues because an experimenter used a piece of marble to hold a barrel of petroleum in place, and a month later saw the petroleum colors had penetrated the marble. . . . A leaky pipe in a greenhouse led a researcher to the discovery of a superior anesthetic and a new scheme in food processing.

Airplanes and numerous other twentieth-century marvels owe much to another accident. George Lee, a New York collar-button manufacturer, decided to start making aluminum snap buttons, but in adjusting his machinery to this new device he made the punch much longer than intended.

Much to his surprise, his machine produced a long aluminum tube instead of a flat button, for the soft metal was forced by pressure through the small opening between the punch and the die. By accident, Lee thus invented the modern process of fashioning seamless tubes from thin metal, one of the most important discoveries in metal working.

Pasteur's remark is still true: "In the fields of observation, chance favors only the minds which are prepared." Dr. Justus Liebig, who had many brilliant discoveries to his credit when he died in 1872, advised, "If one only works, he is always sure to make discoveries no matter where he starts."

THE idea sounds like moon dust, but the Australians are powdering their reservoirs to keep them from evaporating. And it works. In calm weather evaporation losses are cut 50 per cent. Wind reduces the effectiveness of the powdering. Dusting is a new, more efficient way of spreading a film of cetyl alcohol one molecule thick over the top of the water. Once the powdered alcohol hits the water, it dissolves and spreads over the surface.

Science in the news

The supersonic jet race is on. President Kennedy has announced the intention of the Government to join with private industry in developing a supersonic airliner. France and Britain are already working together to produce the Concorde--a 1,500 mph airliner. It would be able to fly from New York to London or Paris in 2½ hours. Delivery has been promised in 1968. Some experts say we won't have supersonic airliners ready before 1971 or 1972. In that case, it's argued, the U.S. should aim at a 2,000-mph plane.

To land, flip a switch. That's the gist of a new electronic system for all-weather landings successfully tested by Sud Aviation of France. A Caravelle jet airliner equipped with the system made over 400 "hands off" landings, several in close to zero-zero weather.

"A new aeronautical milestone" is announced by Northrop. Its X-21, with slits in its wings, reduces drag, increases range 50 p.c.

The battle on pesticides gathers momentum. Rachel Carson, who started it all with her book "Silent Spring," told a Senate subcommittee that chemical poisons tend to increase once they're released in nature. She asked for curbs in their sale and use and urged that effective substitutes be developed. Secretary of Interior Stewart L. Udall said, "There is practically no place on earth wherein the residues of these materials are not found, in soil, in water, and in the tissues of living matter." The Agriculture Department cancelled a plan to spray a forest in Washington State with DDT. The subcommittee itself ordered an inquiry into the relationship, if any, between chemical poisons and some children's ills.

They won't win an Oscar, but they may save people's lives. University of Pennsylvania radiologist Dr. Richard H. Chamberlain reports the development of X-ray motion pictures. Now doctors will be able to diagnose more exactly by watching organs at work.

Cancer research continues apace: 1. A new compound, developed by New York's Sloan-Kettering Institute, reduces the white blood corpuscle count in some types of leukemia. It's called hydroxyurea. 2. British medical statistics reveal a geographic factor. In Japan, for instance, breast cancer is rare; in the U.S., stomach cancer is down, lung cancer is up; in Singapore, only one of 69 liver cancer sufferers was born there.

Is the Russian space effort bogging down? The first flight by a woman in space impressed many. But experts say the scientific significance was nil. The cosmonaut who preceded her in orbit apparently tried to link up with her, yet achieved no more success than cosmonauts in the first twin flight. In the UN, the U.S. said the Soviets failed to report six space launchings. Observers believe Moscow wanted to hide the failure of efforts to reach the moon, Mars and Venus.

Politics and personalities are creating difficulties in the U.S. space effort. Former President Eisenhower said it was "nuts" to spend $40 million to reach the moon. NASA head James E. Webb said it would cost $20 million. And if the U.S. followed Ike's advice, it "would suffer from lack of foresight." Meanwhile, a reported clash led to the resignation of Webb's manned-space-flight aide, D. Brainerd Holmes.

New facts about space are turned up almost daily. CIT's Jet Propulsion Laboratory bounced radar signals off Mercury, found it has a rough surface like the moon's. The Hooker telescope on Mr. Wilson spotted water vapor on Mars. Soviet expert S.V.Vernov said the cosmic rays reaching earth from other solar systems have doubled in intensity in five years as our sun has neared its minimal activity period.

Science in the news

Everybody is getting into the space act. West Germany is planning four space projects, including a rocket with glider wings so it can be used again and again. Italy plans to launch an earth satellite next year, to measure the drag of tiny traces of air along its orbit.

The world weather watch has a new eye. It's the Tiros 7 weather satellite. Within two hours of launching, it was sending back pictures of cloud cover to help warn men of storm systems that it sometimes takes the usual weather methods several days to spot.

R&D is going up and up and so is Uncle Sam's share in it. The National Science Foundation reports that research and development by the aircraft and missiles industry in 1961 totaled $4 billion. That's an 81 percent increase over 1956. Total industrial R&D funds increased 65 percent during the same five-year period. Reason for the difference: the high volume of U.S. funds for R&D on space and defense. Another revelation: Four aircraft and missiles firms accounted for 50 per cent of the industry's R&D funds in 1961.

Americans and Aussies have much in common, but.... Three Australian scientists speculate that their huge island has drifted 3,400 miles from North America in 100 million years.

Radiation fallout in the U.S. will be two or three times greater this year than last. How much danger that means is the big question. Congress has been pressing for official guidelines. The Administration says it's pressing its scientific advisers. But a year's delay is seen. One report says that Washington is surprised at the high radioactivity resulting from nuclear tests in space. And scientists, in setting standards, have little to go on. One official view: At least, the fallout radiation will be less than we get from natural causes and as a result of peaceful atomic projects.

The atom story: Dr. Glenn T. Seaborg, AEC chairman, says Soviet progress in peaceful uses of the atom equals that of the U.S. Fresh from a Russian tour, he also reports both countries will explore joint building of a giant atom smasher. Meanwhile, Soviet scientists report the synthesis of a new isotope of element 102. It lasts 8 seconds.

QUOTE OF THE MONTH: "We are convinced that we are at the threshold of a new and important marine food industry which, if it can be helped safely over the first difficult stages of development, will assume a position of major importance here in the United States and abroad." Secretary of the Interior Stewart L. Udall, speaking before the recent World Food Congress.

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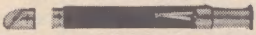

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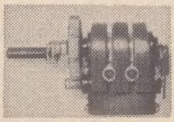

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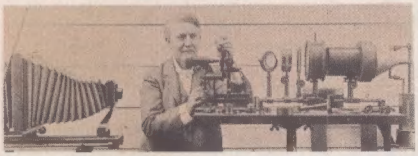


No man symbolizes American ingenuity and old-fashioned hard work like Thomas A. Edison. His work has had more effect on your life than that of any other man in modern times. For a fascinating and revealing album of photographs of the life of this rough hewn genius, see page 6.

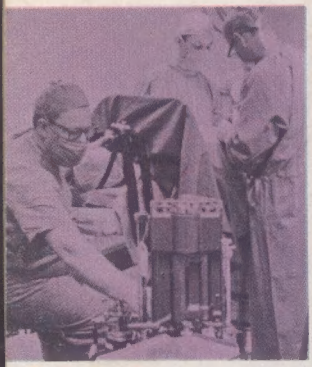
The aesculape snake is something of a gourmet. But you probably wouldn't care for his choice of food. Page 30.

High in the Andes of Peru, the once mighty Incas built a city in which they could hide from the advancing conquistadores. The city was so well concealed that it remained "lost" for centuries. Page 39.

The flea loves everybody, but not everybody loves the flea. How much more do you know about our six-legged friends and enemies? Page 69.

Just 25 miles from New York City, suburban residents are fighting hard to save a swamp from housing developers. They recognize it as one of nature's treasures. Page 83.

This fellow lived millions of years ago. But you'll see him moving around again at the 1964 New York World's Fair. A preview of this spectacular fair exhibit appears on pages 56 and 57.



The benefits of anesthetics are well known. They gave man a mastery over his ancient enemy—pain, and made modern surgery possible. But there are dangers too. What are they? Page 77.

Many an unhappy traveler has bitterly complained that his feet were killing him. Perhaps it was because he didn't use his head about his feet and pack the right type of traveling shoes. Page 21.

Some day you may be asked to take a lie-detector test even if you don't have a run-in with the law. Lie detectors are becoming increasingly important outside of criminal investigation. Your job and your word may depend on the outcome of the test. Is the lie detector really that good, or is it an inexact tool often operated by incompetents? Page 23.